Liebert

Power Quality Solutions

Liebert Hipulse E

Hi-Availability UPS
Uninterruptible Power Supply

500 kVA - 50/60 Hz

EN

Installation and User Manual

SINGLE UNIT AND '1+N' (EXPANDABLE)

EMERSON™
Network Power

Dear **Customer**,

Please allow us to congratulate you on choosing a Liebert manufactured Uninterruptible Power Supply (UPS) system.

If this is your first Liebert UPS, we cordially welcome you to a lifetime relationship of post-sales support designed to keep your Liebert UPS and your systems permanently at their peak performance.
If you already own and use a Liebert UPS, then we are doubly honoured by your decision to continue this valued relationship.

It is our constant endeavour to partner you to ensure the growth & success of your business;
our philosophy is reflected in our mission statement "**Keeping Business in Business**".
Please give us your valued feedback to help us realise our mission.

EMERSON NETWORK POWER

This manual contains information concerning the installation, and operation of the Liebert Hipulse E Single Module (Expandable) Uninterruptible Power System (UPS).

All relevant parts of the manual should be read **prior** to commencing installation.

The UPS must be commissioned and serviced by an engineer approved by the manufacturer (or his agent).

Failure to do could result in personnel safety risk, equipment malfunction and invalidation of warranty.

The Liebert Hipulse E UPS has been designed for Commercial/Industrial use only, and is not recommended for use in any life support applications.

Warning: This is a product for restricted sales distribution to informed partners.
Installation restrictions or additional measures may be needed to prevent disturbance.
(See EN 50091-2)

While every precaution has been taken to ensure accuracy and comleteness in this manual, Liebert Corporation assumes no responsibility and disclaims all liability for damages resulting from use of this information or for any errors or omissions.

Liebert Corporation pursues a policy of continual product development and reserves the right to change the equipment design without notice.

This manual describes the following equipment:

EQUIPMENT	*PART NUMBER*
500 kVA UPS Module (12 Pulse)	5410340A-E
Battery circuit breaker box (BCB) 1250 A	4646018A
Battery circuit breaker control board	4520079F
Battery temperature board	4532029V
Top cable entry cabinet (without connection bars)	5312134W-E
Top cable entry cabinet (with connection bars)	5312135X-E
Maintenance bypass cabinet - *1+ 1 Configuration (two UPS's with parallel redundant connection)*	5312157T-E
Mechanical Castell Interlock BP1	4644044C
Mechanical Castell Interlock BP2	4644045D
Optional kit to uprate the neutral cut-off current rating	4641163H

Safety Precautions

CONFORMITY AND STANDARDS

This equipment complies with the following requirements:
Normative references: Uninterruptible Power System (UPS).
** IEC 62040-1-1 (2002) — 'General and safety requirements for use in operator access area';*
** EN 50091-2 (1995) — 'EMC requirements';*
** IEC 62040-3 (2001) — 'Performance requirements and test methods';*
** EN 60950 (2001) — 'Information technology equipment;*
** EN 60529 (1989) — 'Degrees of Protection provided by enclosures (IP Code)'*
and published technical standards. For more details, see Chapter 5 'Conformity and standards'.
Continued compliance requires installation in accordance with these instructions and the use of manufacturer approved accessories only.

WARNING

HIGH EARTH LEAKAGE CURRENT: EARTH CONNECTION IS ESSENTIAL BEFORE CONNECTING THE INPUT SUPPLY.

This equipment must be earthed in accordance with local electrical codes.

Caution

This equipment can be fitted with RFI suppression filters (optional).

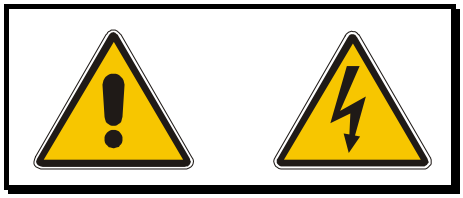
Earth leakage current exceeds 3.5 mA and is less than 1000 mA.
Transient and steady-state earth leakage currents, which may occur when starting the equipment, should be taken into account when selecting instantaneous RCCB or RCD devices.
Residual Current Circuit Breakers (RCCBs) must be selected sensitive to DC unidirectional pulses (class A) and insensitive to transient current pulses.
Note also that the earth leakage currents of the load will be carried by this RCCB or RCD.

WARNING

This system has a signal available for use with an automatic device, externally located, to protect against backfeeding voltage through the mains Static Bypass circuit. If this protection is not used with the switchgear that is used to isolate the bypass circuit, a label must be added at the switchgear to advise service personnel that the circuit is connected to a UPS system.
The text is the following or equivalent:

ISOLATE THE UNINTERRUPTIBLE POWER SYSTEM BEFORE WORKING ON THIS CIRCUIT.

Guide to the Instructions



The warning triangle indicates all the personal safety instructions.
Follow these instructions carefully to avoid injury.

General

As with other types of high power equipment, dangerous voltages are present within the UPS and battery enclosure. The risk of contact with these voltages is minimized as the live component parts are housed behind a hinged, lockable door. Further internal safety screens make the equipment protected to IP20 standards.
No risk exists to any personnel when operating the equipment in the normal manner, following the recommended operating procedures.
All equipment maintenance and servicing procedures involve internal access and should be carried out only by trained personnel.

Batteries

Battery manufacturers supply details of the necessary precautions to be observed when working on, or in the vicinity of, a large bank of battery cells. These precautions should be followed implicitly at all times.
Particular attention should be paid to the recommendations concerning local environmental conditions and the provision of protective clothing, first aid and fire-fighting facilities.

WARNING

Follow these instructions scrupulously:

The Liebert Hipulse E is designed exclusively for indoor use. Protect the unit from excessive condensation and install it in a place free of flammable liquids, gases and corrosive substances.
Electrical installation must be performed by a qualified electrician.
Personnel working with the equipment described in this manual must be thoroughly familiar with the product.
Before making connections inside the unit, make sure that all incoming power sources are de-energised and insulated.
When the incoming power source is active, the unit contains a dangerous level of voltage, even when it has "maintenance bypass" status.
To insulate the unit, turn it off and insulate all incoming power sources and auxiliary power sources.

Support Information:
If you require assistance for any reason, please have the following information available:

Model and size	
Part number	
Serial number	
Date installed	
Location	
Voltage & Frequency	
Battery reserve time	

Table of Contents

Part II – User Manual 7-1

Part I – Installation Manual

1 Chapter 1 - Installation Procedure

1.1 Introduction

WARNING

Do not apply electrical power to the UPS equipment before the arrival of the commissioning engineer.

WARNING

The UPS equipment should be installed by a qualified engineer in accordance with the information contained in this chapter and all equipment not referred to this manual is shipped with details of its own mechanical and electrical installation.

WARNING

Battery hazards

Special care should be taken when working with the batteries associated with this equipment. When connected together, the battery terminal voltage will exceed 500 VDC and is potentially lethal.

Eye protection should be worn to prevent injury from accidental electrical arcs.
Remove rings, watches and all metal objects.
Only use tools with insulated handles.
Wear rubber gloves.

If a battery leaks electrolyte, or is otherwise physically damaged, it must be replaced, stored in a container resistant to sulphuric acid and disposed of in accordance with local regulations.

If electrolyte comes into contact with the skin the affected area should be washed immediately with water.
For more details, see Chapter 3 'Battery Installation'

Note

The UPS System can also be connected to an IT (isolated neutral) power system.

This section describes the UPS system's environmental requirements and mechanical considerations that must be taken into account when planning the positioning and cabling of the UPS equipment.

Because every site has its peculiarities, it is not the aim of this chapter to provide step-by-step installation instructions, but to act as a guide as to the general procedures and practices that should be observed by the installing engineer.

1.2 Environmental considerations

1.2.1 UPS location

The UPS module should be located in a cool, dry, clean-air environment with adequate ventilation to keep the ambient temperature within the specified operating range (see Chapter 5 — UPS Environmental).
All models in the 'Liebert Hipulse E' UPS range are cooled with the aid of internal fans.
Cooling air enters the devices through the ventilation grids located at various points on the cabinet and is released through the grids on the roof. To permit air to enter and exit and prevent overheating or malfunctioning, do not cover the ventilation openings.
When the cabinet is located on a raised floor, and bottom cable entry is used, additional cooling air also enters the UPS via the floor void. If necessary, a system of extractor fans should be installed to aid cooling-air flow, and a suitable air filtration system used where the UPS is to operate in a dirty environment.

Note 1: When batteries are cabinet-mounted adjacent to the UPS module, it is the battery which dictates the designed maximum ambient temperature, not the UPS.

Note 2: Power losses from the System, which may be used to size an air conditioning system are intended for operation using the Inverter, as in the ECOMODE configuration they would be undersized.

Air filters:

The optional dust filters can be installed behind the air intake in the front door(s). By opening the front door, the filters can be changed easily without exposing personnel to high voltage. A schedule for inspection of the air filters is required. The period between inspections will depend upon environmental conditions.

1.2.2 Battery location

Temperature is a major factor in determining the battery life and capacity. Battery manufacturers quote figures for an operating temperature of 20°C. Operating above this temperature will reduce the battery life, operation below this temperature will reduce the battery capacity. On a normal installation the battery temperature is maintained between 15°C and 25°C. Batteries should be mounted in an environment where the temperature is consistent and even over the whole battery. Keep batteries away from main heat sources or main air inlets etc.
If the batteries are rack-mounted, or otherwise located remote to the main UPS cabinet, a battery circuit breaker must be mounted as close as possible to the batteries themselves, and connected using the most direct route possible.
The battery circuit breaker controller board must be used in conjunction with the battery circuit breaker.
This control board, which should be located near to the battery circuit breaker, interfaces with the UPS control system.

1.2.3 Storing

If unit is to be stored before installation, it is recommended to store the unit in a dry environment with temperatures in the range of -25°C to 70°C. Use original packing materials or other suitable means to keep the unit clean.

1.3 Mechanical Considerations

1.3.1 System composition

A UPS system can comprise a number of equipment cabinets, depending on the individual system design requirements - e.g. UPS cabinet, External Bypass cabinet. In general, all the cabinets used in a particular installation are of the same height and designed to be positioned side-by-side to form an aesthetically appealing equipment suite.
The 500 kVA UPS is split into two cabinets to allow easier transportation and positioning, one houses the Inverter and the other houses the Rectifier/Static Bypass.
Once the equipment is positioned and prior to fixing the equipment in place, the two cabinets have to be bolted together and the interlinking power and control cable connections made.
Refer to the installation drawings provided in Chapter 6 for positioning of UPS cabinets.

1.3.2 Frame and enclosure

The UPS is housed in an IP20 enclosure, designed for floor mounting. The top and side removable panels are secured to the chassis by screws. The door can be opened to give access to the power connections bars, auxiliary terminal blocks and power isolators. Front door can be opened at 180° for better Service and more flexibility in installations.
The UPS comes with an operator control panel, which provides basic operational status and alarm information. The cabinet houses the power components, control boards and fuses. The cabinet is structurally designed to handle lifting from the base. Cooling is by internal removable fans.

1.3.3 Moving the cabinets

The route to be travelled between the point of arrival and the unit's position must be planned to make sure that all passages are wide enough for the unit and that floors are capable of supporting its weight (for instance, check that doorways, lifts, ramps, etc. are adequate and that there are no impassable corners or changes in the level of corridors).

WARNING

Ensure any lifting equipment used in moving the UPS cabinet has sufficient lifting capacity.

EXERCISE EXTREME CARE WHEN HANDLING UPS CABINETS TO AVOID EQUIPMENT DAMAGE OR INJURY TO PERSONNEL.

Ensure that the UPS weight is within the designated surface weight loading (Kg/cm^2) of any handling equipment. See the UPS specification for weight details - see Table 5-3.
UPS and optional cabinets (battery cabinets, top cable entry cabinets, etc.) can be handled by means of a fork lift or similar equipment. For operations with a fork lift, it is necessary to remove either the lower protection panel located at the base of the cabinet and rear panels (or both side panels). Be aware of the location of the *load supporting feet* so as not to damage them, refer to installation drawings in Chapter 6.
In the eventuality that the equipment cannot be moved by fork lift, then rollers should be used.
Because the weight distribution in the cabinet is uneven, use extreme care during handling and transporting.
When moving the unit by forklift, lift the unit from the rear so as to protect the front panel. Do not exceed a 15 degrees tilt with the forklift. Bottom structure will support the unit only if the forks are completely beneath the unit.
The handling with straps is not authorised.
Note: Do not move the battery cabinet with the batteries fitted.

1.3.4 Clearances

Liebert Hipulse E has no ventilation grills at either side or at the rear of the UPS. To enable routine tightening of power terminations within the UPS, it is recommended that service access of 800 mm (minimum) be allowed for at the rear. Clearance around the front of the equipment should be sufficient to enable free passage of personnel with the doors fully opened. It is important to leave a distance of 800 mm between the top of the UPS and the ceiling of the room in which it is installed to permit adequate circulation of air coming out of the unit.

1.3.5 Floor installation

Installation diagrams in Chapter 6 of this manual identify the location of the holes in the base plate through which the equipment can be bolted to the floor. If the equipment is to be located on a raised floor it should be mounted on a pedestal suitably designed to accept the equipment point loading. Refer to the base view to design this pedestal.

1.3.6 Fixing of the magnetic components

Before the equipment is in place, remove the transportation restraints that hold the input inductance and output transformer in place.

1.3.7 Cable entry

Cables can enter the UPS cabinet from bottom.

Note *When selecting the power cables for side entry to a module located on a solid floor, consideration must be given to the minimum permissible radius of the proposed cables to ensure that they can be fashioned to reach the UPS connection busbars.*

1.3.8 Top Cable entry

Optionally a top cable entry extension may be used, see the figures in Chapter 6.
For 500 kVA models, Liebert offers two types of cabinets that have the same height and depth of the UPS, but a substantially different content. In the full optional cabinet, power cables (a.c./d.c.) are connected by means of copper bars fitted on a horizontal metal support. The empty cabinet is instead used only to thread the cables that have to be connected to the UPS bus bars.
Power cables must be anchored to the supporting uprights provided by means of special straps.
The top cable entry option is fitted on the left side of the UPS cabinet and is supplied without side panels; the side cover from the UPS being used. They must be mechanically connected using the holes on the UPS uprights.
This facilitates cable entry through the top aluminium panel after the appropriate cable entry holes have been cut.
The optional cabinet can be handled by means of a fork lift or similar lifting equipment.

Note 1: The top cable entry (P/N 5312135X) also includes the power connection cables between the cabinet and the UPS.

Note 2: For special installation requirements regarding the position of the optional unit for incoming cables entering from the top, special alternatives to the standard position are available.

1.4 Preliminary Checks

Before you install the UPS hardware you should carry out the following preliminary checks:

1. Verify that the UPS room satisfies the environmental conditions stipulated in the equipment specification, paying particular attention to the ambient temperature and air exchange system.
2. Remove any packaging debris, then visually examine the UPS and battery equipment for transit damage, both internally and externally. Report any such damage to the shipper immediately.

1.4.1 Identification

The equipment supplied has an identification tag on the back of the main door reporting:
The type, size, and main calibration parameters of the UPS. A metal disk fastened to the inside top of the cabinet is engraved with its serial number.
Record the model and serial numbers in the table at the beginning of this installation manual. A record of this information is necessary should servicing be required.

2 Chapter 2 - Installation (Electrical)

The UPS requires both «power» and «control» cabling once it has been mechanically installed. All «control» cables, whether screened or not, should be run separate from the power cables in metal conduits or metal ducts which are electrically bonded to the metalwork of the cabinets to which they are connected.

2.1 Power Cabling

WARNING

BEFORE CABLING-UP THE UPS, ENSURE THAT YOU ARE AWARE OF THE LOCATION AND OPERATION OF THE EXTERNAL ISOLATORS THAT CONNECT THE UPS INPUT/BYPASS SUPPLY TO THE MAINS DISTRIBUTION PANEL.
CHECK THAT THESE SUPPLIES ARE ELECTRICALLY ISOLATED, AND POST ANY NECESSARY WARNING SIGNS TO PREVENT THEIR INADVERTENT OPERATION.

For cable entry, refer to section 1.3.7.

2.1.1 Cable rating

The main factors affecting the choice and size of cable are voltage, current (also taking into account overcurrent), room temperature and conditions of installation of the cable.

Note: Correct cable size must also take into account the system's overload capacity (see Chapter 5 – Technical Specifications: - Electrical Characteristics).

The power cables of the system must be sized with respect to the following description:
Module input cables
The module input cables must be sized for the maximum input current, including the maximum battery recharge current, given in table 2-1, with respect to the module rating and the input a.c. voltage.

WARNING

***Note:** for a common input power configuration (single supply) interconnecting cables are required, connecting the rectifier input with the bypass input **(links about 1.5m long)**, with cables sized for the maximum input current in table 2-1.*

Module Bypass and output cables
The bypass and output cables must be sized for the nominal output current, given in table 2-1, with respect to the module rating and the output a.c. voltage.
Battery cables
Each UPS module has its own battery, which is connected using two cables, one positive and one negative. The battery cables must be sized for the battery discharge current at the end-of-discharge voltage, as given in table 2-1 with respect to the module rating.

Note: The table below gives nominal currents for determining the size of UPS power cables. Other factors, which must be taken into consideration include cable route length, coordination with protective devices, etc.

2.1.2 Table for determining power cable size

The power cables can be sized to suit the UPS module rating according to the table below:

UPS RATING (kVA)	NOMINAL CURRENT: Amps							BUSBAR STUD SIZE			
	Input Mains with full battery recharge (12-pulse rectifier)			Bypass\Output at full load			Battery at minimum battery voltage (400Vac)*	Input Cables	Output/ Bypass cables	Battery Cables	Torque Load (Nm)
	380V	400V	415V	380V	400V	415V		Bolt/ hole			
500	985	935	902	783	744	717	1060	M12 Ø13			45 (M12)

Table 2-1 UPS Module cabinet power cable rating

*Maximum battery discharge current at 380VAC supply increase by 3%, and for a 415VAC supply decrease by 3%

2.1.3 General Notes

The following are guidelines only and superseded by local regulations and codes of practice where applicable:

1. Take special care when determining the size of the neutral cable, as current circulating on the neutral cable may be greater than nominal current in the case of non-linear loads. Refer to the values given in the 'UPS Electrical characteristics' table in Chapter 5.
2. The earth conductor should be sized according to the fault rating, cable lengths, type of protection, etc. The earth cable connecting the UPS to the main ground system must follow the most direct route possible.
3. Consideration should be given to the use of paralleled smaller cables for heavy currents, as this can ease installation considerably.
4. When sizing battery cables, a maximum volt drop of 3Vd.c. is permissible at the current ratings given in Table 2-1.
5. In most installations, especially those concerning parallel multi-module systems, the load equipment is connected to a distribution network of individually protected busbars fed by the UPS output rather than being connected directly to the UPS itself. Where this is the case the UPS output cables can be rated to suit the individual distribution network demands rather than being fully load-rated.
6. When laying the power cables, do not form coils, so as to avoid increasing formation of electromagnetic interference.
7. In parallel multi-module systems, the output cable of each unit should be kept as equi-distant as possible between the unit output terminals and the parallel distribution busbar to prevent from affecting the shared current.

2.1.4 Cable connections

The rectifier input, bypass, output and battery power cables (all require lug type terminations) are connected to busbars situated below the power isolators - as shown in Chapter 6. These are accessible when the power compartment cover plate is removed.
A terminal block X3 is used for connecting the control cables to the battery circuit breaker and a second terminal block X4 is used for the external emergency stop facility, external OFF inverter, ext. Bypass, etc. these are female spade type connections (Fast-on 6,3 x 0,8) and are described later in Section 2.3.

2.1.5 Safety earth

The safety earth busbar is located near the input and output power supply connections as shown in Chapter 6. The safety earth cable must be connected to the earth busbar and bonded to each cabinet in the system.

All cabinets and cable trunking should be earthed in accordance with local regulations.

Note: *Proper grounding considerably reduces problems in systems caused by electromagnetic interference.*

WARNING

FAILURE TO FOLLOW ADEQUATE EARTHING PROCEDURES CAN RESULT IN ELECTRIC SHOCK HAZARD TO PERSONNEL, OR THE RISK OF FIRE, SHOULD AN EARTH FAULT OCCUR.

2.1.6 Protective devices

For safety reasons, it is necessary to install, external to the UPS system, circuit breaking protective devices in the input a.c. supply and towards the battery. Given that every installation has its own characteristics, this chapter provides general useful information for qualified installation engineers, with knowledge of operating practices, of regulatory standards, and of the equipment to be installed.

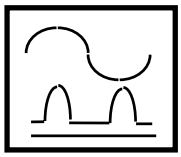
Rectifier and Bypass input supply of the UPS:

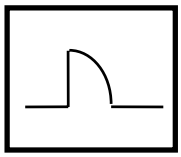
Protection against excessive overcurrents and short circuits in the mains supply input:

These inputs must be protected, installing suitable protective devices at the distribution panel of the incoming main supply, considering that the protection should discriminate with overload capacity of the system (see Chapter 5 — Specification: - Electrical Characteristics).

Split bypass: in the case of a split bypass being used, separate protective devices should be installed in the incoming mains distribution panel.
The protective devices must be selected for the nominal input current, with respect to the UPS rating and the input a.c. supply voltage as given in table 2-1.

Protection against earth faults (RCD devices):
In the event of a differential (RCD) device being installed upstream of the input supply, one must take into account the transient and steady state earth leakage currents that are produced during start-up of the UPS.
The presence of an RFI suppression filter inside the UPS, determines a residual earth current greater than 3.5 mA and less than 1000 mA.
Residual current circuit breakers (RCCB) must be sensitive to d.c. unidirectional pulses (class A) in the network and insensitive to transient current pulses.
They are identified by the symbols respectively:





These isolators must have an average sensitivity, possibly adjustable between 0.3 and 1A.
It is recommended that the selectivity with every differential switch be verified both upstream of the input distribution board and downstream (towards the load).

Parallel 1+N:
Use of differential circuit breakers on UPS unit inputs in a configuration with separate inputs and one battery for each unit requires installation of a common device only on the System Bypass Mains.

UPS Battery:

The UPS Battery is protected by means of a control circuit that operates the tripping mechanism of an automatic circuit breaking device (having a variable trip setting). The tripping mechanism using an undervoltage release coil that operates on a preset minimum voltage level.

The circuit breaker is essential for maintenance of the battery and is normally located near to the battery installation. The characteristics and operation of the automatic circuit breaker are given in Chapter 3.

Output of the System:

In the eventuality that an external distribution panel is used for load distribution, the selection of protective device must provide discrimination with those that are used at the input to the UPS module.

2.1.7 Cabling procedure for 500 kVA UPS with 12 pulse rectifier

Important

The operations described in this section must be performed by authorised electricians or qualified technical personnel. If you have any difficulties do not hesitate to contact our Customer Service & Support department at the address given at the beginning of this manual.

Make electrical power and auxiliary connections and mechanically connect the cabinets in the UPS once the equipment has been put in position, but before it is anchored in place permanently.

Electrical power and auxiliary connections between the two cabinets must be made from the front of the UPS.

Study the connection diagram as illustrated in Chapter 6.

Power connections between the rectifier / static sw. cabinet and the inverter cabinet

1. Open the inside doors to access the cabinet connection bars.
2. Connect the pre-arranged cables coming out of the connection bars, situated next to the rear right upright of the static switch cabinet, to the T1 transformer of the inverter cabinet. Power cables must be inserted in the slot provided for cable threading. Connect, in sequence, cables (#25) from the neutral bar to 'T1-N', cables (#16) from terminal I1 of the static switch cabinet to 'T1-a', cables (#17) from terminal I2a to 'T1-b' and finally cables (#18) from terminal I3 to 'T1-c'. Connect the cables in the order listed.
3. Connect the pairs of cables (+/-) already supplied coming out of the UPS rectifier bridge to the inverter cabinet connection bar. The wire numbered 31 (+) must be connected to the positive bar, while the wire numbered 30 (-) must be connected to the negative bar. Be careful to comply with connection polarity.
   Note: Make all connections with a torque of 45 Nm for M12 bolts.

Auxiliary connections between rectifier / static sw. cabinet and inverter cabinet

Open the inner door on the left side of the inverter cabinet and make the following auxiliary connections:

4. Insert the flat cables supplied in the inverter cabinet into the fixed connectors on the static switch cabinet. The ribbon cable W20 must be connected to X47, while the ribbon cable W21 must be connected to X48.
5. Also insert loose connector (X39) into the fixed 12-way connector on the right; repeat the same operations for loose connector (X40), inserting it into the fixed 4-way connector.
   Note: Be careful to comply with connection instructions precisely.

Power connections inside the rectifier / static sw. cabinet

Once the equipment has been finally positioned and secured, connect the power cables as described in the following procedure.
Study the reference drawing provided in Chapter 6.

6. Verify that the UPS equipment is totally isolated from its external power source and all the UPS power isolators are open. Check that these supplies are electrically isolated, and post any necessary warning signs to prevent their inadvertent operation.
7. Open the rectifier cabinet access door and remove the metal guard on the lower left hand side to gain access to the connection bars. The protective cover on the rectifier cabinet must be removed subsequent to removal of the handle on the rectifier input isolator.
8. Connect the safety earth and any necessary bonding earth cables to the copper earth busbar located on the floor of the equipment below the power connections. All cabinets in the UPS must be connected to the user's ground connection.

   Note: The earthing and neutral bonding arrangement must be in accordance with local and national codes of practice.

   Identify and make power connections for incoming cables according to one of the two procedures below, depending on the type of installation:

Common Input Connections

9. For common bypass and rectifier inputs, connect the **a.c. input supply** cables between the mains distribution panel and the UPS **rectifier input busbars** (U1-V1-W1 terminals) and tighten the connections to 45 Nm (M12 Bolt). Additional connecting cables must be used (see note in the paragraph 2.1.1) from the **rectifier input bars** (U1-V1-W1) to the **bypass input bars** (U3-V3-W3). The input neutral cable must be connected to the bypass input bar (N3).

   Note: It is important that the connections between the **input cables** from the external distribution box and the **additional cables** (links) are connected to the rectifier input bars (U1-V1-W1).

ENSURE CORRECT PHASE ROTATION.

Split Bypass Connections

10. If a 'split-bypass' configuration is used, connect the **a.c. input supply** cables to the **rectifier input busbars** (U1-V1-W1 terminals) and the **a.c. bypass supply** cables to the **bypass input basbars** (U3-V3-W3-N3 terminals) and tighten the connections to 45 Nm (M12 Bolts).

ENSURE CORRECT PHASE ROTATION.

Output System Connections

11. Connect the system **output cables** between the **UPS output busbars** (U2-V2-W2 N2 terminals) and the **critical load** and tighten the connections to 45 Nm (M12 Bolt).

ENSURE CORRECT PHASE ROTATION.

WARNING

If the load equipment will not be ready to accept power on the arrival of the commissioning engineer then ensure that the system output cables are safely isolated at their ends.

UPS Battery Connections

12. Connect the **battery cables** between the UPS terminals (+\-) and its associated **battery circuit breaker** (as shown in Chapter 6).

    Note: When connecting the cables between the battery extremities to the circuit breaker always connect the circuit breaker end of the cable first.

    The auxiliary cables of the battery must be **screened and double insulated**. Connect screened auxiliary cables from each **battery circuit breaker controller board** (P/N 4520079F) to the **UPS auxiliary terminal block** (X3) (as shown in Chapter 6) of their metal frame of the battery circuit breaker cabinet (if used).

OBSERVE THE BATTERY CABLE POLARITY.

WARNING

Do not close the battery circuit breaker before the equipment has been commissioned

Auxiliary Connections

13. Connect the auxiliary cables of any external interface/signals to the respective connections of the output auxiliary terminal block (X4) (see Chapter 6).

14. Refit the lower metal protective cover and the handles on the UPS power isolators.

2.2 Distance from floor to connection point on the equipment:

UPS	UPS 500 kVA minimum distance (mm)
Rectifier a.c. Input supply	355
Bypass a.c. Input supply	510
UPS Output a.c.	777
Battery Power	404.5/ 454.5
Auxiliary cables: Battery Control / Temp. Compensation (X3)	460
Communications to AS400/External Alarm monitor	400
Remote Emergency Power Off (EPO) (X4)	455
Earth	244.5

Table 2-2

2.3 Control cables

2.3.1 Battery Control

The battery circuit breaker is controlled by the battery circuit breaker controller board, which is located within the Battery Cabinet — or adjacent to the battery circuit breaker when the batteries are rack-mounted. This board controls the circuit breaker's undervolt release coil and also provides a path for the circuit breaker auxiliary contacts to signal the circuit breaker status back to the UPS control logic. All connections between the controller board and the UPS module are made via the Auxiliary Terminal Block (X3), which is located in the base of the UPS Cabinet.

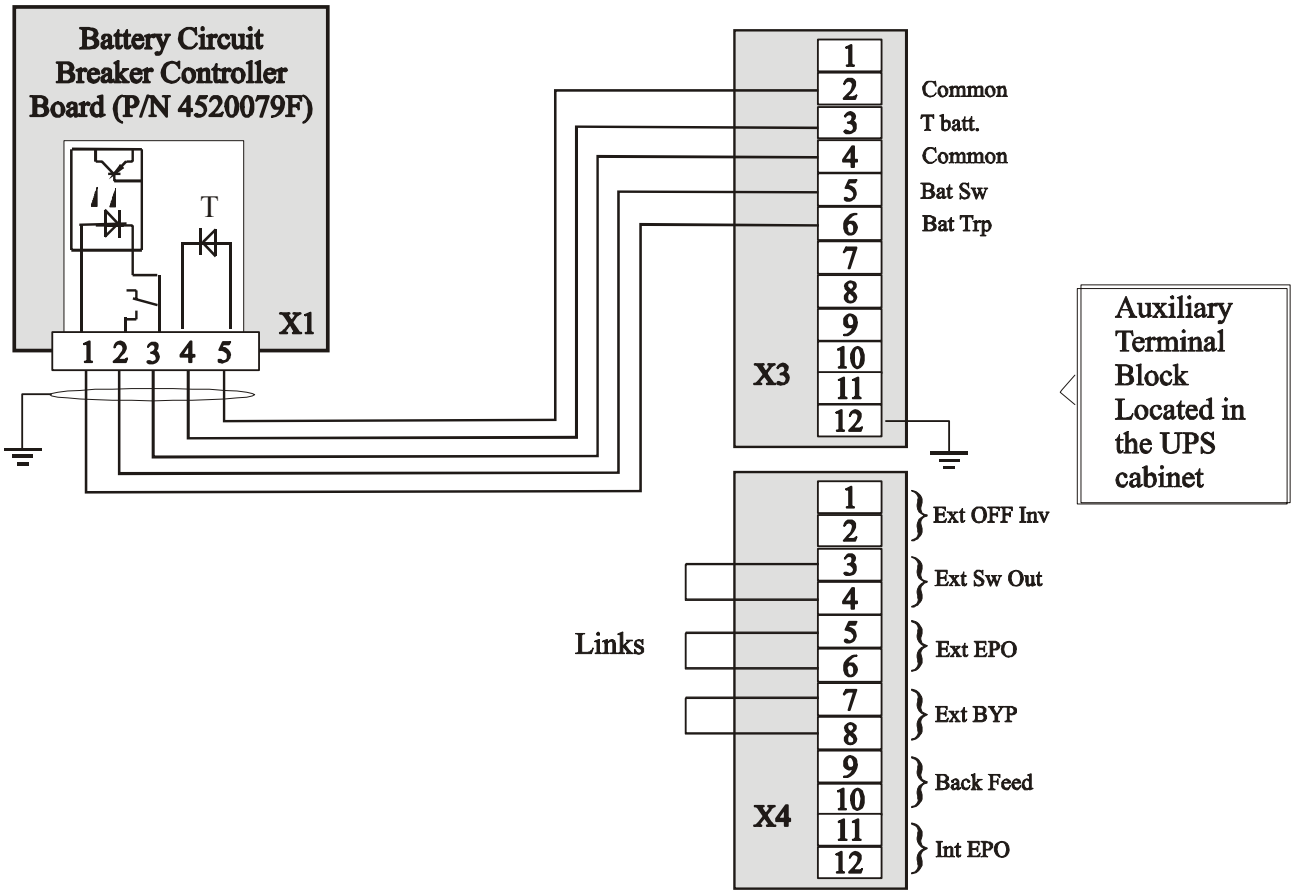


Figure 2-1 Auxiliary terminal block detail

Connect the battery circuit breaker control and temperature compensation cables between the UPS auxiliary terminal block and battery circuit breaker controller board as shown in figure 2-1. These cable must be shielded and double insulated, shield should be connected at protective earth of battery cabinet or battery breaker, not at UPS.

Caution

If battery temperature compensation is not used the system must be de-activated by the commissioning engineer.

Auxiliary terminal block X3 at UPS.

X3 terminal reference	Reference label	Description
2	Common	Temperature sensor common (0V)
3	T Batt.	Temperature sensor signal
4	Common	Common (0V)
5	Batt. Sw	Battery circuit breaker open
6	Bat Trp	Battery circuit breaker trip control

Table 2-3

Note: The auxiliary cables of the battery must be **screened and double insulated**.
The screen is connected to the earth of the battery circuit breaker cabinet or supporting rack.
Use multiple-core shielded cables with a section of 0.5 to 1 mm^2.
Connect the cables with the Fast-on 6.3x 0.8 mm terminals (female).

2.3.2 Auxiliary terminal block X4

Next to terminal board X3 there is a second terminal board, which may be used for auxiliary connection of equipment or devices external to the UPS. Use the following table to identify the terminals corresponding to the equipment or device to be connected.

Auxiliary terminal block X4 at UPS.

X4 terminal reference	Reference label	Description
1-2	Ext. OFF Inv	Remotely provides control for switching off the inverter. The external contact employed must be normally open with the input switch open.
3-4	Ext. Sw Out	Indication to be provided at the UPS to note the opening of an external module output isolator. The external contact employed must be normally open with the output switch open. If unused, leave the standard connectors in place.
5-6	Ext. EPO	Remotely provides control for switching off the UPS using a remote emergency button. Normally closed contact. If unused, leave the standard connectors in place.
7-8	Ext. BYP	Indication to be provided at the UPS to note the opening of an external maintenance bypass switch. The external contact employed must be normally closed with the external maintenance bypass switch open. If unused, leave the standard connectors in place.
9-10	Back Feed	Signal from the UPS to indicate a return flow of energy in the bypass mains. The contact employed is normally open; if it is closed, this means a failure has been detected. Refer to point 2.3.4 on the next page.
11-12	Int EPO	One contact is available for opening an external EPO switch assembled upstream of the UPS. The normally closed contact is opened when the internal emergency button is pressed. See Note 2 on the next page.

Table 2-4

Note: All auxiliary cables of terminal block X4 must be **double insulated**.
The cross-sectional area of the auxiliary cables is from 0.5 to 1 mm^2.
Connect the cables with the Fast-on 6.3x 0.8 mm terminals (female).
Maximum contact rating on auxiliary terminals: 50 Vdc @ 1 Amp.

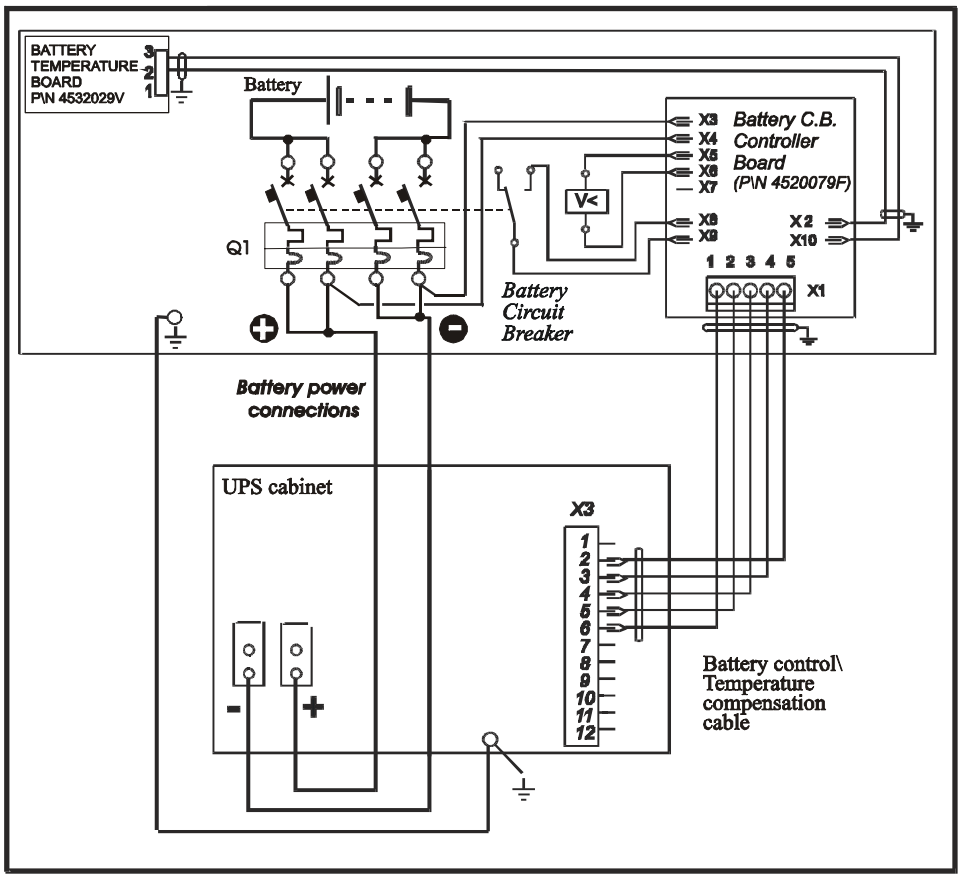


Figure 2-2 Battery Connection

2.3.3 Emergency Stop

If an external Emergency Stop facility is required it is connected to terminals 5 & 6 of the Auxiliary Terminal Block (X4) and connected to the `normally closed' remote stop switch between these two terminals using shielded cable. If this facility is not used then terminals 5 & 6 must be linked-out as shown in Figure 2-1.

Note 1 *The Emergency Stop action within the UPS shuts down the rectifier, inverter and static bypass and trips the battery circuit breaker. It does not however internally disconnect the input mains supply. If required, this additional action can be facilitated by feeding the UPS input via an isolator, which can be tripped by a second contact of the Emergency Stop switch.*

Note 2 *Terminals 11 & 12 of the Auxiliary Terminal Block (X4) are connected to a «normally closed» contact of the UPS Display Panel emergency Stop button and go open circuit when the button is pressed. This output can be used as part of a wider Emergency Stop system to initiate an external action (such as tripping an external supply breaker).*

2.3.4 Back Feed Protection

Using an auxiliary terminal (pins 9-10 of connector X4) the UPS provides a normally open contact to be used for opening of an external circuit protection device, to protect the operator against backfeed of energy resulting from a short-circuit fault of the Bypass line SCRs. This auxiliary contact can be used, for example, in series with an external low voltage source, in order to supply the trip coil of an automatic circuit breaking device, located upstream of the UPS Bypass mains input. In the event of energy being backfed the auxiliary circuit will activate closing the normally open contact and as a result opening of the external circuit breaking device; the UPS is disconnected from the Bypass mains supply. The electrical characteristics of the auxiliary contact are 50V (a.c. or d.c.) @ 1 Amp.

2.3.5 Fan Failure Alarm Indicator (Optional)

Liebert Hipulse E is designed to allow the installation of a device to control the correct operation of fans.
The kit includes the Fan Failure Alarm Indicator, interconnection components (loose and anchored connector) and related wiring. This function employs an electromagnetic device installed on each individual fan, which gives an alarm signal on the operator display panel and turns on a Led on the Fan Failure Alarm Indicator in the event that a fan slows down or shuts down entirely.
If an alarm displays on the operator control panel, determine the physical location of the faulty fan using the identification lable placed next to the "Fan Failure Alarm Indicator card".
A remote signal may be provided by installing appropriate alarm interface cards.

2.3.6 Battery ground fault detection (Optional)

To guarantee a continuously uninterruptible power supply to the critical load, single module UPS or parallel UPS systems are provided with external batteries, so the battery insulation to PE (Protection Earth) shall be monitored to be in a safe range. For this purpose the battery system is fitted with a DC monitoring device to detect and eliminate earth faults to ensure operational continuity, this is included in a Battery Fault Detection Set.
The Battery Ground Fault Detection is the same for all UPS sizes.
When a battery ground fault is detected, an alarm will appear on the display panel (if the interface card is installed within UPS and X6 jumper has fitted on 2-3).
A remote warning may be provided by installing an other alarm interface card.

The Battery ground fault detection (P/N 4645336U) contains fault detection device only. The wiring cables are already installed within UPS. This option is fitted on DIN guide as shown in the installation drawings in Chapter 6.

3 Chapter 3 - Battery Installation

3.1 Introduction

The UPS battery consists of battery blocks connected in series to provide a nominal d.c. input voltage for the UPS inverter. The required '*AUTONOMY TIME*' (the time that the battery can maintain supply to the load in the event of a mains failure) is limited by the ampere hour size of the individual battery blocks and in some cases this could mean several strings are connected in parallel.
Usually, with UPS installations in the high power range covered by the 'Liebert Hipulse E' equipment, the batteries are contained in a dedicated battery room. It must be possible to install batteries of various types and capacity in the battery room to obtain the required autonomy characteristics.

If multiple sets of batteries connected in parallel are used to provide the required battery autonomy, each set should be fitted with an isolating devices to permit work to be performed on one set of batteries while the others remain in service.

It must be possible to disconnect the battery from the UPS module when undertaking maintenance or service procedures. This is facilitated by means of a suitably rated circuit breaker which must be located as close as possible to the battery terminals, and the power and control cables connected to the UPS using the most direct route possible. The circuit breaker can be switched manually ON or OFF but should also contains an under-voltage release mechanism (having a variable trip setting) which is used in conjunction with battery circuit breaker controller board.

For battery room assembly, Liebert offers a battery circuit breaker option (the rating of which depends on the size of the UPS) including a battery circuit breaker controller board (the same for all sizes). This box is designed to be either wall-mounted or assembled on a frame, and is connected between the UPS and the battery. Refer to section 3.8 for more information.

3.2 Safety

Special care should be taken when working with the batteries associated with the 'Liebert Hipulse E' UPS System equipment. When all the cells are connected together, the battery terminal voltage will exceed 500V and is potentially lethal. A primary safety consideration is to physically isolate the battery installation from all but appropriately qualified maintenance personnel; which is best achieved by locating the cells in a key-lockable cabinet or a purpose-designed, dedicated battery room. Specific battery cabinet and battery room design details are given later in this section.

WARNING

The following general battery safety precautions and WARNINGS should be observed at all times:

a) A battery can present risk of electric shock or burn from high short circuit currents.

b) When connected in a string the voltage could be 540V d.c. this voltage is potentially lethal always observe high voltage precautions.

c) Only qualified personnel should install or service batteries.

d) Eye protection should be worn to prevent injury from accidental electrical arcs.

e) Remove rings, watches, necklaces, bracelets and all metal objects.

f) Only use tools with insulated handles.

g) Wear rubbers gloves and a rubber apron when handling batteries.

h) If a battery leaks electrolyte, or is otherwise physically damaged, it should be placed in a container resistant to sulphuric acid and disposed of in accordance with local regulations.

i) If electrolyte comes into contact with the skin the affected area should be washed with plenty of clean water immediately.

j) Batteries must always be disposed of according to local environmental laws.

k) When replacing batteries use the same number and type that were originally fitted.

l) Disconnect charging source prior to connecting or disconnecting battery terminals.

m) Determine if the battery is inadvertently grounded. If inadvertently grounded, remove source of ground. Contact with any part of a grounded battery can result in electrical shock.

3.3 UPS Batteries

Battery can be VRLA, Ni-Cd or wet cell type.
It is common practice in UPS installations to use valve regulated cells. The term '*valve regulated*' is used currently in place of either '*sealed*' or '*maintenance free*' both of which have been used in the past.
Valve-regulated cells are not 'sealed,' and will vent. The amount of gas given off is less than for a flooded cell but when considering the design of the battery installation allowances must be made for adequate ventilation and heating of the cells. Boost charging must not be applied to valve regulated cells as this will cause them to overcharge and subsequently vent.
Similarly, valve-regulated cells cannot be regarded as 'maintenance-free' as they must be kept clean and their connections checked periodically for tightness and lack of corrosion. It is not possible to check the cells' specific gravity directly but the battery can be checked by the 'CS PG battery service programme' which can give an indication of faulty cells or cell degradation within the battery.
Batteries are fully charged before delivery; however, storage and transportation times mean that, inevitably, some charge is lost by the time the battery is commissioned. All the cells forming the battery should be brought to the same state of charge and be recharged within 6 months of the factory charge.
It is especially important that the battery is fully charged before attempting a witness test of the autonomy time. This may require several days to complete; therefore any witness test concerning the batteries should take place only after the battery has been on uninterrupted float charge for at least one week.
Cell performance typically improves after a few weeks in service or after two or three discharge/recharge cycles.

3.4 Installation design considerations

Note:	*full safety instructions concerning the use and maintenance of UPS batteries are provided in the appropriate battery manufacturers manuals. The battery safety information contained in this section relates to key considerations which must be taken into account during the installation design process and might affect the design outcome depending on localised conditions.*

3.5 Battery Installation and Maintenance

3.5.1 Temperature considerations

Battery performance depends on the ambient battery temperature. Capacity and autonomy times are quoted for a new battery operating at 20°C. Battery capacity is increased by 1% for every 1°C increase in temperature up to 25°C. If a battery is used at temperatures above 25°C, its life is reduced; consequently its capacity and UPS autonomy time will reduce more rapidly over a period of time. Operating below 20°C will reduce the battery capacity by approximately 1%-1.5% per 1°C. For example: if a battery discharge test is attempted during the middle of winter when the ambient temperature is 5°C the battery capacity will be only 77.5% of its design value and will not satisfy its specified autonomy time.

Ambient temperature, ventilation, spacing, float voltage and ripple current all affect the battery temperature. Uneven temperature distribution through the battery string will cause the voltage distribution to be uneven which can also lead to problems — it is therefore important to maintain a even temperature across the whole battery chain.

'Valve-regulated' cells are very sensitive to temperature and should be operated at a temperature between 15°C and 25°C. To help sustain this operating temperature range the battery is normally float charged at 2.25V/cell.

When batteries are mounted in the same room to the UPS module, it is the battery which dictates the designed maximum ambient temperature, not the UPS. — i.e. in the case of 'valve-regulated' cells the ambient room temperature should be kept between 15°C and 25°C, and *not* between 0°C and 40°C (which is the specified main equipment operating temperature range). Temperature excursions are permissible for short periods of time provided the average temperature does not exceed 25°C.

3.5.2 Battery population

The nominal DC bus voltage, and therefore battery float voltage, is set according the module's rated input/output voltage, and usually set to 513Vdc (380Vac), 540Vdc (400Vac) or 567V (415Vac). Given that the desired cell float voltage is 2.25V, this means that a different number of cells are required in each case (see Chapter 5 - DC Intermediate Circuit).

3.6 Battery protection

The battery is connected to the UPS through a circuit breaker which is manually closed and electronically tripped via the UPS control circuitry. If the cells are rack -mounted (or located remote from the main UPS cabinet), this circuit breaker, fitted within the cabinet, must be positioned as near as possible to the batteries themselves, and the power and control cables connected to the UPS using the most direct route possible. The UPS electronic circuitry will trip the circuit breaker if any of the following conditions occur:-

a) If the d.c. busbar drops below 401V d.c. (This would normally occur during a mains failure when the battery autonomy time has been exceeded.
b) If there is a rectifier problem and the d.c. bus rises above (2.45 V/cell exceeded on the battery).
c) If the Emergency Stop is operated.

Note: All equipment servicing procedures should be carried out only by trained personnel.

3.7 Battery installation

3.7.1 Fitting & connecting the batteries

The following notes, in conjunction with the diagrams, illustrate the broad principles to be followed when fitting and connecting the majority of battery installations.

3.7.2 Fitting the batteries

1. In general a minimum space of 10 mm must be left on all vertical sides of the battery block to permit free air movement around the cells.
2. Clearance should be allowed between the top of the cells and the underside of the shelf above (this is necessary for monitoring and servicing the cells).
3. When installing the batteries on racks always work from the bottom shelf upwards to prevent raising the centre of gravity.

3.7.3 Connecting the battery

1. When the battery circuit breaker cabinet is installed on a raised floor the battery power cables and circuit breaker control cables can be routed to the UPS cabinet via the floor of the cabinet. If the UPS and battery circuit breaker cabinet are located adjacent to each other and located on a solid floor these cables can be passed between the cabinets via the lifting apertures located in the lower sides of the cabinets.
2. In general it is recommended that the inter-connecting cables are fitted to the batteries within their particular level before fitting the inter-level connecting cables, followed finally by the cables to the circuit breaker.
3. An insulating shroud should be fitted to each terminal after its connection has been made.
4. When connecting the cables between the battery extremities to the circuit breaker always connect the circuit breaker end of the cable first.

3.7.4 Battery room design

Whatever the type of mounting system selected, the following conditions should be noted:

❶ Layout of cells:

Whatever battery mounting system is used, the batteries should be laid out in such a manner as to make simultaneous contact with two exposed live parts having a potential greater than 150V impossible. Where this is *not* possible, insulated terminal shields must be installed and insulated cables must be used for connections.

❷ Service platform:

The service platform (or duckboard) must be slip-proof, insulated from the floor and be at least one metre wide.

❸ Connections:

All connections must be as short as possible.

❹ Battery protection circuit breaker:

The battery circuit breaker is generally installed at the front of the battery room. The connection of Circuit Breaker Box available for the 'Liebert Hipulse E' is described in the following paragraph.

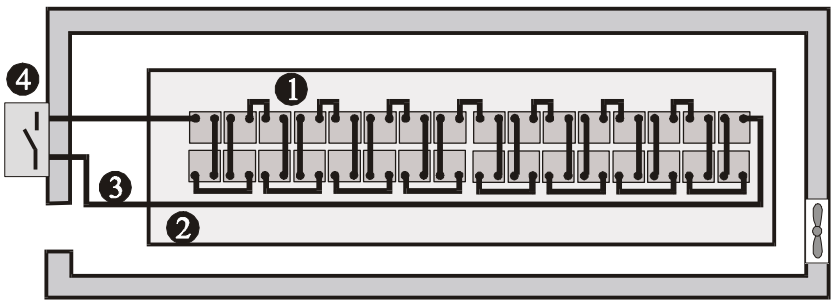


Figure 3-1 Battery Room Design

3.8 Battery circuit breaker box

The box contains a battery isolating Circuit Breaker and the Circuit Breaker Controller Board (P/N 4520079F) as also mounted in the Battery cabinet.
A range of battery circuit breaker boxes is available for use in installations where the battery is not installed in the battery cabinet, in which case the appropriate battery box is fitted as close as possible to the battery and connected to the UPS equipment as illustrated in Figure 3-3.

The battery circuit breaker box, used with the Circuit Breaker Controller Board, is required to protect the battery from deep discharging and overcurrents. It also provides electrical isolation between the UPS and the battery, permitting technical service personnel to reduce the risks involved in maintenance work to a minimum. Inside the box are connection bars for power cables arriving from the UPS and from the battery.

Note: The control cables from the UPS module to the Controller Board must be made using a 5-core shielded cable located in a separate conduit to that containing the battery power cables.
The control signal cable is connected to the Circuit Breaker Controller Board (P/N 4520079F) through the terminal board (X1).
The cable shield must be earthed to prevent induced noise affecting the control operation, and a separate safety earth must be connected between the UPS module and Circuit Breaker Box.

UPS (kVA)	Dimensions (H-W-D) (mm)	Weight (Kg)	Circuit Breaker	Cable entry
500	1000x600x300	48	1250A 4p	Top & bottom

For mechanical details refer to the information shown in the following figures.

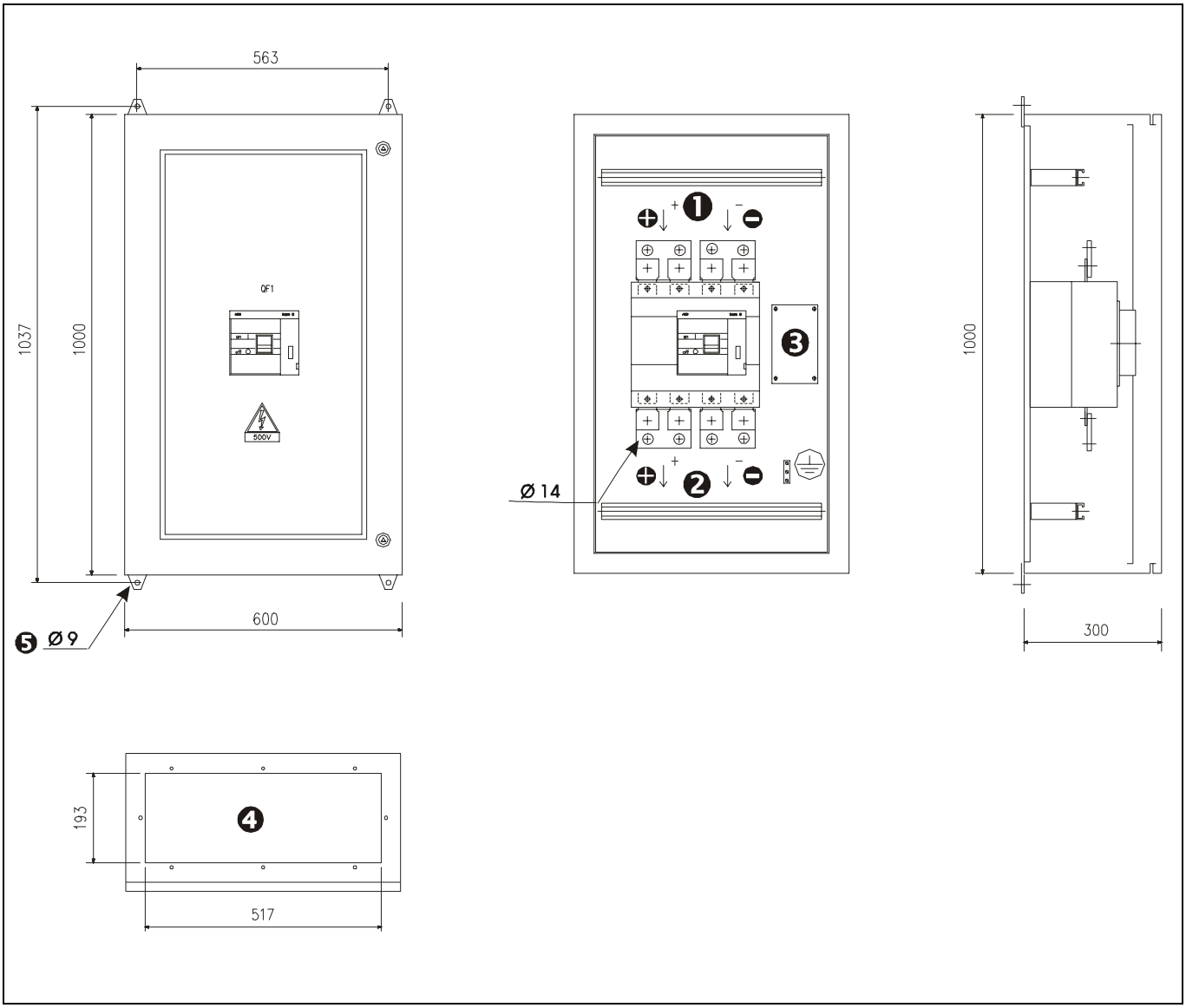


Figure 3-2 Battery circuit breaker box

	LEGEND
❶	Battery connections (+/-)
❷	Connections from UPS (+/-)
❸	Battery circuit breaker controller board
❹	Cable entry: top and bottom. User to size and cut holes for the cables to be used.
❺	Wall mounting holes

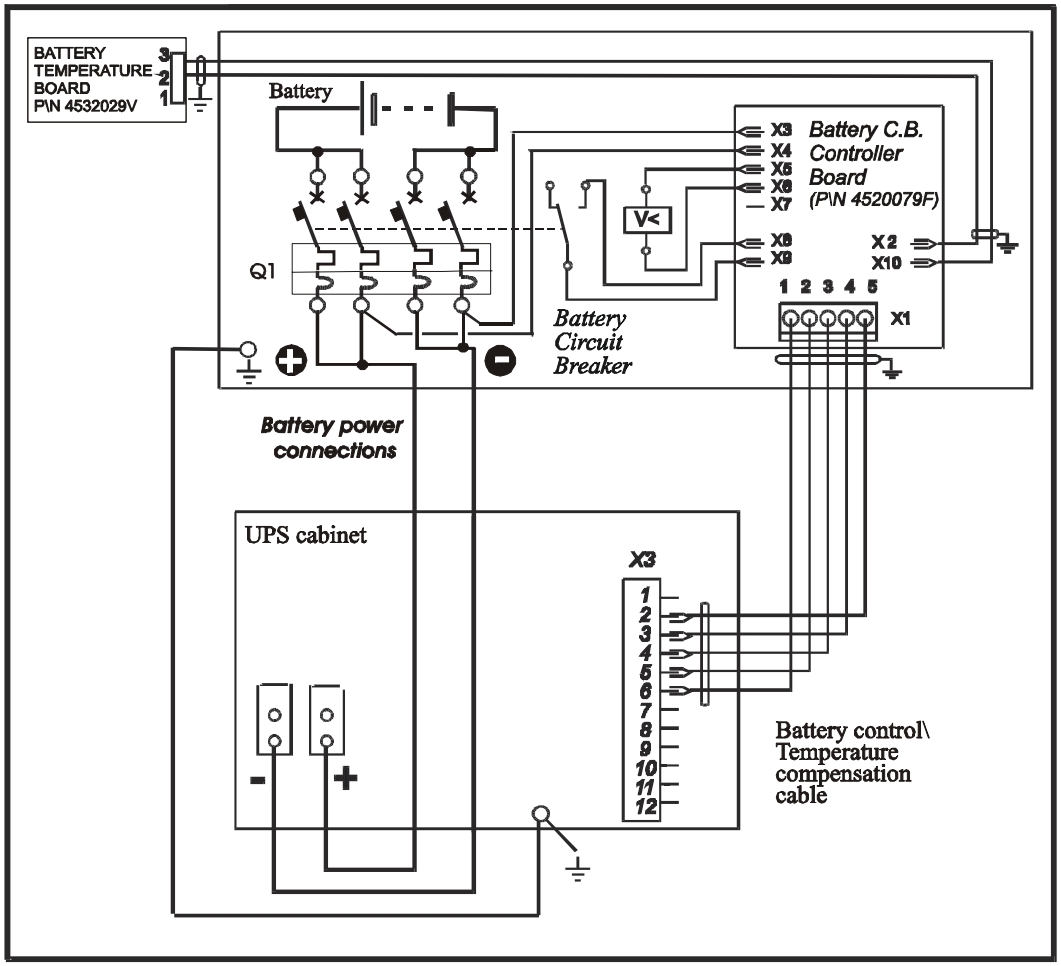


Figure 3-3 Battery circuit breaker box connection

3.8.1 Battery Temperature Board (Optional P/N 4532029V)

A battery temperature sensor card, supplied separately from the battery circuit breaker, is connected with the UPS logic through the battery circuit breaker control card.
With this feature fitted, the nominal float voltage supplied to the battery is adjusted so as to be inversely proportional to the ambient battery cabinet/room temperature. This prevents the battery being over charged at high ambient temperatures.

This page is left blank intentionally

4 Chapter 4 - 1+N System

4.1 General

The 1+N system has two or more (up to a maximum of six) modules of the same size (kVA). The load is equally divided between the units that form the system. The system can be of two types:

- Parallel power
  All the UPS's are able to provide the full power requested for the load.
- Parallel redundant
  The system comprises a higher number of UPS's able to provide the full power required for the load.
  For more detailed information on the operating principle of 1 + N parallel systems, see Chapter 7.

The 1+N system is used to:

- Increase the reliability of the system in order to ensure a good supply to the critical load connected.
- Increase the power availability (system expansion) in the event an unforeseen power demand occurs. This guarantees a greater flexibility in relation to the critical load connected.
- Increase serviceability and allow the execution of maintenance operations and reparations without affecting the ordinary operating conditions of the system (depending on the redundancy level).

The system can comprise of up to 6 UPS modules of the same power rating connected in parallel without the need for a centralized mains static bypass.
The following components are installed inside each UPS unit in the 1+N parallel system:
The parallel logic board, the parallel connector board and the corresponding flat connection cables.
From a '*power'* viewpoint each module is internally identical to the 'single module' configuration. A 1+N parallel system requires inverter and bypass supplies, inter-module control signals to manage current sharing, synchronizing and bypass switching between the modules. In figure 4-1 this is shown as the 'inter-module control bus', which is facilitated through the use of multi-way ribbon cables connected between the units of the system.
The number and length of these flat cables is determined by the positioning of the equipment in the system, so this supply is determined when the order is placed.

If the load is transferred onto a static bypass line, in a configuration in which three or more units are connected in parallel, there may be a problem dividing up currents on the power circuit. Each case is different, and depends on the length of the cables used, for example the resistance upstream and downstream of the static bypass line.
The differences between the impedances could result in undesirable division of currents over one or more UPS units. This problem may be solved by including an optional inductance on the static bypass line of each UPS unit.

Note: For each additional UPS unit, the operator control panel must be programmed with the correct size and the configuration of the static switch must be identified as 'internal'.

1 + N Configuration (>2 UPS's) or two UPS's with parallel power connection

IMPORTANT

(*) With configurations consisting of two UPS's with parallel power or 1+N systems integrated with more than two UPS's, where the load level is above the rated power of the single UPS, it is necessary to install an adequate external maintenance bypass. It is also necessary to adopt all the measures required to prevent the internal manual bypass switch of the UPS (Q3) from being used. This can be done by removing the handle of the switch and by placing a warning label for the maintenance personnel.

For information on the external maintenance bypass, see paragraph 4.3.

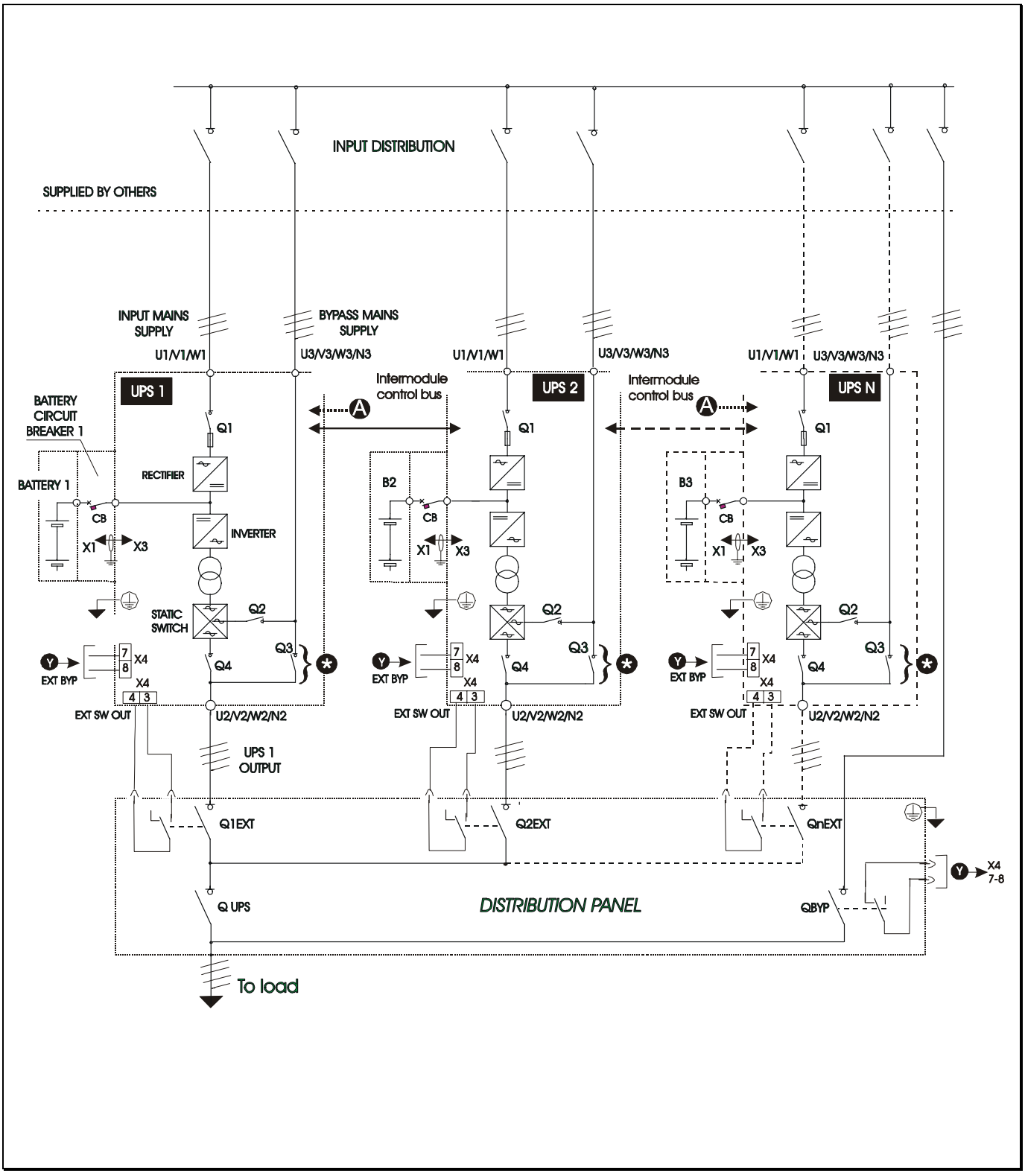


Figure 4-1 '1+N' System block diagram with separate batteries.

(*) See the warning message at the bottom of page 4-1.

4.2 Installation procedure

4.2.1 Preliminary Checks

Be sure that a parallel kit is present and fitted in each of the modules, and that the modules are of the same rating and with the same SW and HW release (See paragraph 8.1.2 of the User Manual — The Menu Options).

WARNING

Fitting of the parallel kits and board setting required to convert from Single Module to 1+N must be made by Liebert Service & Support trained personnel.

4.2.2 Protective Devices

Refer to the instructions supplied in Chapter 2 — Electrical Installation - Section 2.1.6.

4.2.3 Power cables

Input Bypass and Rectifier, outputs of modules

For power cabling the installation is the same for each module as described in Chapter 2.

4.2.4 Control cables

Inter-module control

Modules are interconnected as shown in Figure 4-2 using connections to the other UPS modules via the parallel connector board with shielded 34-way cables.

These cables are connected between the 'N' modules to pass control signals which govern module synchronization, load sharing, battery charge current sharing (in a common battery installation), load transfer operation and other general control and alarm functions. These signals are necessary to ensure correct system operation, and built-in redundancy allows the system to function if ever one of the 'N' cables becomes disconnected.

Inter-module Parallel Connections

1+N Parallel UPS System: Inside the module there is a parallel connection board (P/N 4590060U) mounted on the right hand side of the Static Switch cabinet. Connect one end of the interconnecting ribbon cable to interface connector (X1) of the first UPS module and the other end to connector (X2) of the second module, and so to the next module until a closed loop is formed.

Cable entry is as identified in the mechanical drawings in Chapter 6.

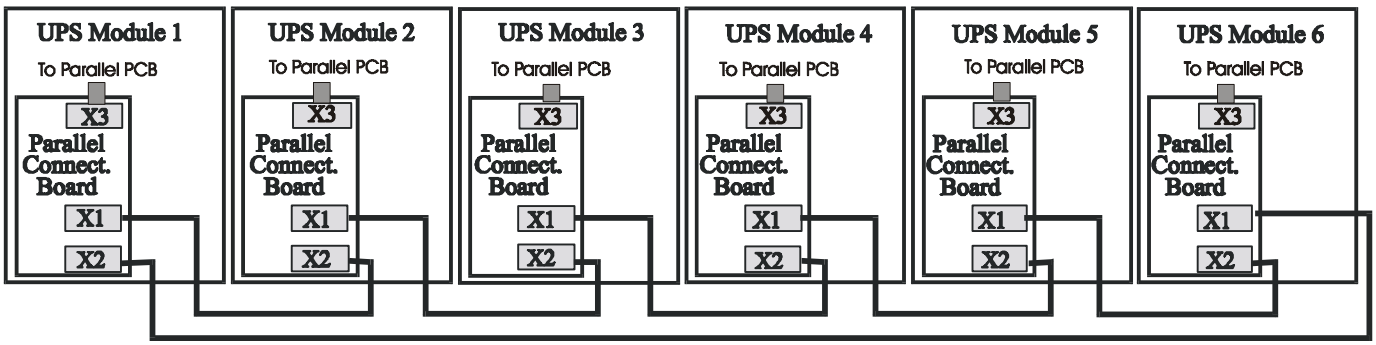


Figure 4-2 Connection of '1+N' system parallel signal bus cables

4.2.5 Emergency Stop (EPO)

The external emergency stop facility is identical to that described for the single module installation — that an individual Emergency Stop button is provided for each module.

Note that this is a normally closed switch.

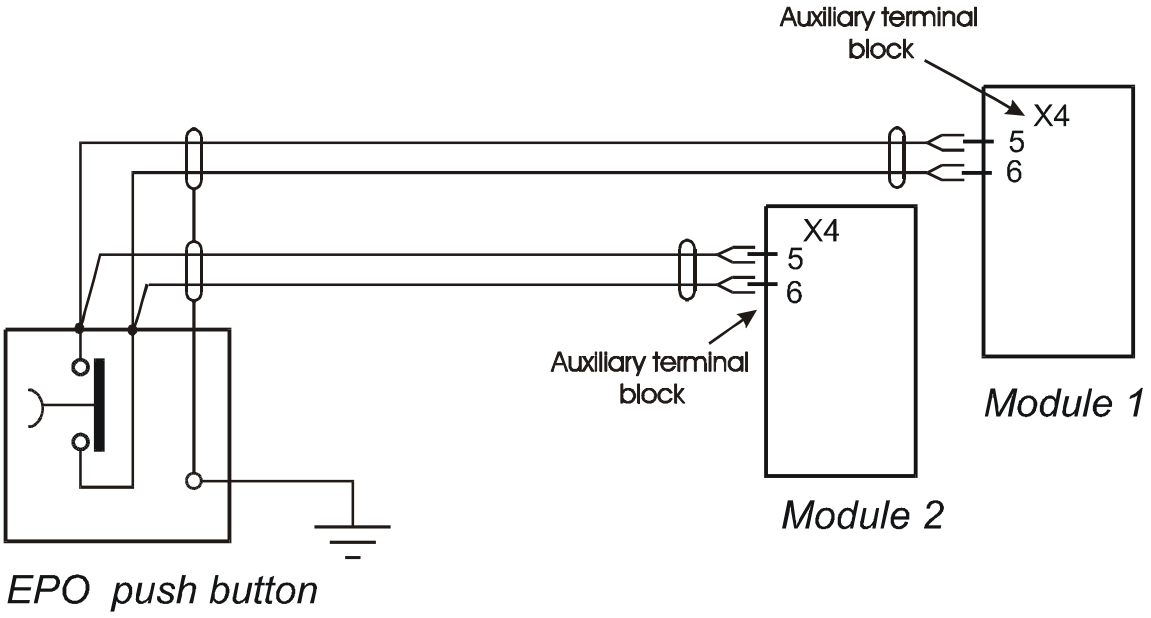


Figure 4-3 Connection of EPO push button.

4.3 Maintenance Bypass cabinet (Option)

Bypass cabinet enables maintenance operations and reparations to be performed in full isolation besides allowing the disabling of each UPS without affecting the ordinary operation of the system (depending on the redundancy level).

The optional maintenance bypass cabinet must be used in all configurations where the internal bypass is not sufficient to guarantee the power requested by the load.

This cabinet comprises:

- A cut-off isolator for the direct line, which disconnects the bypass line from the load
- Two isolators (see **Note 1**) to cut-off single UPS outputs
- A cut-off isolator for the output of the whole UPS system
- A terminal block for the auxiliary connections to the UPS's

Note (1): there are alternative solutions differing from suggested standard for specific installation requirements (i.e. with several UPS cut-off isolators).

Study the reference drawing provided in Chapter 6.

WARNING

Carefully follow the operating procedures provided in this manual to completely disable the UPS. It is useful to remember that all input/output power and battery switches must be open for the UPS to be completely insulated.

The UPS system with external maintenance bypass cabinet offers a standard protection that guarantees the blocking of the inverter and the switching of the load to the bypass line if the maintenance bypass switch is accidentally closed.

4.3.1 Auxiliary connections between the maintenance bypass cabinet and two UPS's

The maintenance bypass box connected to the terminal blocks requires specific control cabling, as described here below.

Maintenance Bypass cabinet		***UPS 2***	
X1-1	*Q2-N.O.*	*X4-3*	*EXT. SW. OUT*
X1-2	*Q2-COM*	*X4-4*	
		UPS 1	
X1-3	*Q1-N.O.*	*X4-3*	*EXT. SW. OUT*
X1-4	*Q1-COM*	*X4-4*	
X1-5	*Q3/4-N.C.*	*X4-7*	*EXT. BYP*
X1-6	*Q3/4-COM*	*X4-8*	
UPS 1		***UPS 2***	
X4-7	*EXT. BYP*	*X4-7*	*EXT. BYP*
X4-8		*X4-8*	

Table 4-1

Note: All auxiliary cables of terminal block X1 must be **double insulated**.
The cross-sectional area of the auxiliary cables is from 1 mm^2.
Connect the cables with the Fast-on 6.3x 0.8 mm terminals (female).
Power and auxiliary cables are not included in the supply.

4.3.2 Castell Interlock

The Castell Interlock enables the operator to close/open the external maintenance bypass switch following the procedure required to release/insert the key. The UPS Liebert Hipulse E system offers two types of Castell Interlock options: mechanical and electromechanical. The type must be selected depending on the configuration of the system installed in the plant.

Castell Interlock	
Configuration of the UPS system	***Type of Castell Interlock***
Two UPS's with parallel redundant connection (1+1)	*Mechanical Castell Interlock*
Two UPS's with parallel power or above two UPS's (1+N)	*Electromechanical Castell Interlock*

The Castell Interlock option is normally used in combination with the power isolators placed inside the external maintenance bypass cabinet.

Note: The Liebert Hipulse E UPS system is already pre-arranged for the installation of this option.

This option comprises:

- A Castell Interlock with key (BP1) for each UPS of the system. The key is normally blocked and released only when the UPS inverter turns off and the load is switched to the static bypass, depending on the active UPS modules.
- A Castell key exchange box. This will receive the keys from all the UPS modules, then release another key (BP2) to use in the Maintenance Bypass isolator.
- A Castell Interlock with key (BP2), situated on the external maintenance bypass isolator. As this isolator is normally open and has no key, it can be closed only with the key (BP2) released by the Castell key exchange box. The key is released only when the isolator is open.
- A Castell Interlock with key (BP2), situated on the UPS output isolator within the external maintenance bypass cabinet. This isolator is normally closed and has a key. The key is released only when the isolator is open.

4.3.2.1 Electromechanical Castell Interlock

This option consists of a Castell key exchange box and of several Castell units with individual key. Their number varies according to the number of UPS's present in the system.
The release of a specific key (BP1) occurs only when the inverter turns off. As a consequence thereof, the load is transferred to the internal static bypass line (the switching operation occurs when the number of active UPS's is lower that the number set in the menu of the operator control panel). The key, which is fixed in position by means of an electromechanical device, can only be removed by pressing the energising button of the solenoid and when the green indicator is on. The keys extracted from the UPS's (n BP1) enable to free a second key (BP2) from the Castell key exchange box and to close the external maintenance bypass isolator, enabling the line that directly connects the bypass mains to the load. To isolate the UPS system, it is necessary to open the UPS output isolator of the external bypass cabinet, the protective devices at the input distribution panel and the battery circuit breaker. At this point, the load is supplied by the direct line inside the maintenance bypass cabinet and it is possible to perform maintenance operations or reparations on the UPS as it is completely isolated.

4.3.2.2 Mechanical Castell Interlock

The description above is valid also for this type of Castell unit, with the following exceptions:

- The maintenance bypass switch (Q3) of the UPS is closed before the external bypass isolator.
- The key (BP1) acts on the maintenance bypass isolator (Q3) blocking (or disengaging) a mechanical stop.
- No button needs to be pressed to extract the key (BP1) on the UPS.

The keys symbols of the Castell Interlocks can be customized to suit the needs of the customer.

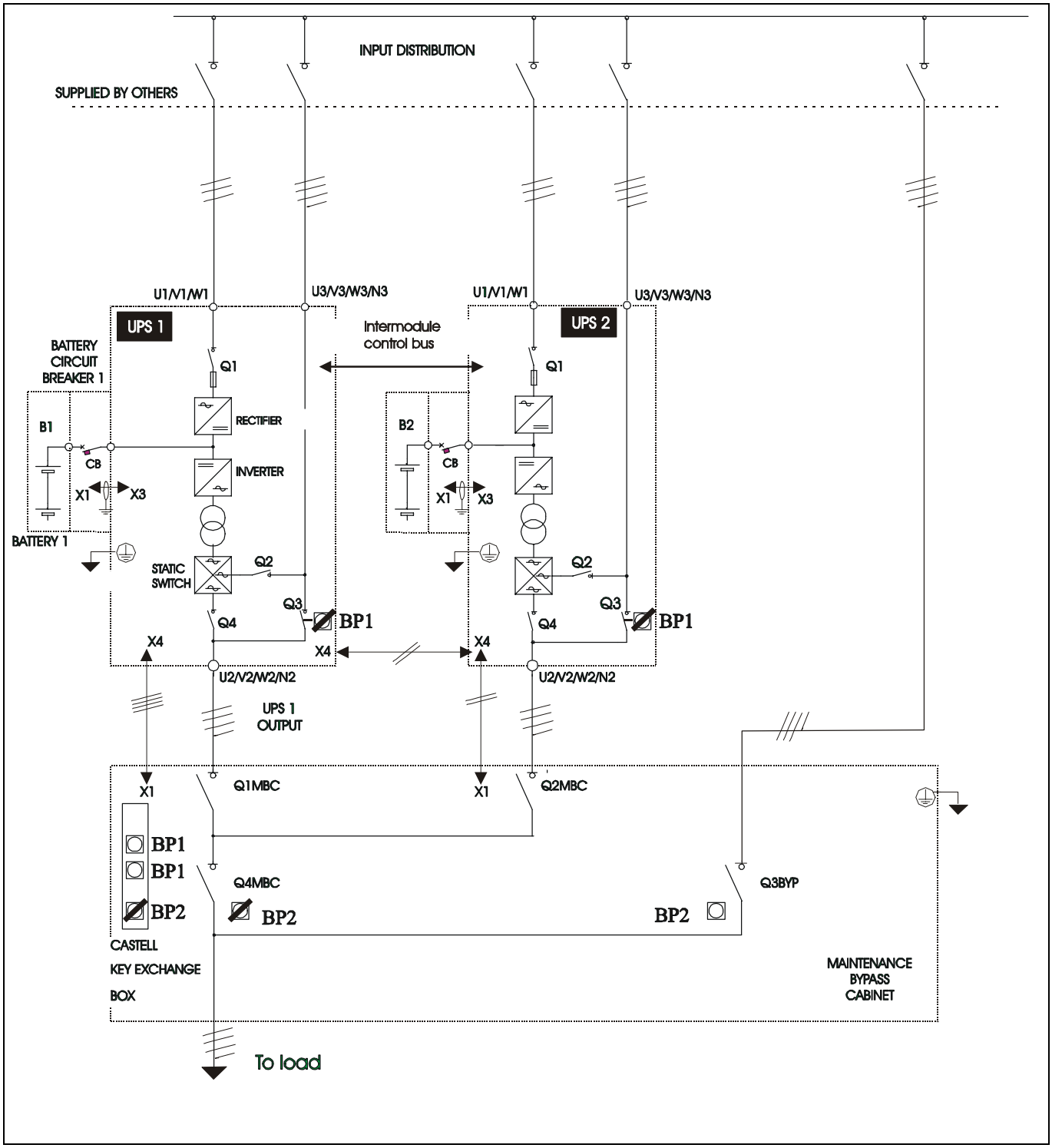


Figure 4-4 Example of configuration with two redundant UPS's connected in parallel with the external maintenance bypass cabinet.

This drawing should show an external maintenance bypass supply for the system (with two redundant UPS's) as referred to in the warning message at the bottom of page 4-1.

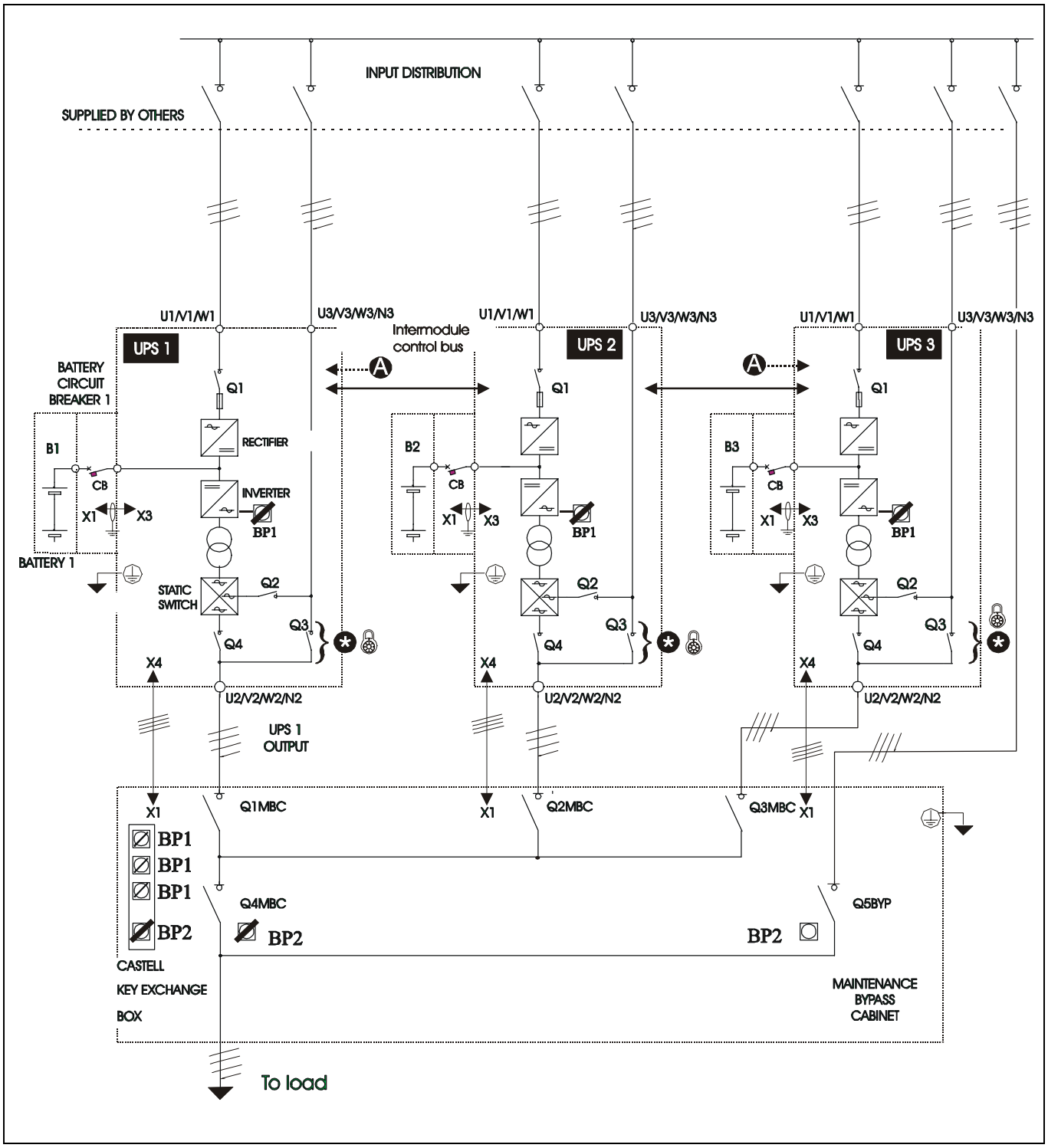


Figure 4-5 Example of configuration with three UPS's connected in parallel with the external maintenance bypass cabinet.

This drawing should show an external maintenance bypass supply for the system (with three UPS's) as referred to in the warning message at the bottom of page 4-1.

5 Chapter 5 - Specification

This specification describes requirements for an Uninterruptible Power System (UPS).

5.1 Conformity and Standard

The UPS has been designed to conform to the following standards:

Description	Year	Normative references
General and safety requirements for UPS used in operator access areas	2002	EN 62040-1-1 IEC 62040-1-1
Emissions requirements	1995	EN 50091-2
Method of specifying the performance and test requirements	2001	EN 62040-3 identical to IEC 62040-3 (1999)
CE marked		

The above mentioned product standards incorporate relevant compliance clauses with generic IEC and EN standards for safety (60950) and construction (60529).
For more details, see below:

Description	Year	Normative references
Information technology equipment	2000	EN 60950
Degrees of protection provided by enclosures (IP code).	1989	EN 60529

5.2 UPS Environmental

The UPS shall be able to operate under the following environmental conditions without damage or degradation in electrical operating characteristics:

ENVIRONMENTAL CHARACTERISTICS	UNITS	
Rated power	**kVA**	**500 (12 pulse rectifier)**
Operating Temperature	°C	0- 40
Maximal temperature for 8 hr day	°C	40°C de-rate power by 1,5% per °C between +40°C and + 50°C
Mean Temperature for 24 h	°C	35
Relative humidity	—	≤ 90% at 20°C
Acoustical noise	dBA	75
Altitude of operation		≤1000m asl de-rate power by 1% per 100m between 1000 and 2000 m
Storage-transport temperature	°C	-25 ÷ 70

5.3 UPS Mechanical Characteristics

MECHANICAL CHARACTERISTICS	UNITS	500 kVA (12 pulse rectifier)	
		Rectifier / Static Sw. section	**Inverter section**
Height	mm	1900	
Width of each section		1230	1230
Total width		2460	
Total width including top cable entry option		3100	
Depth		978	
Weight of each section	kg	1500	2300
Total weight without Input Filter		3800	
Total weight with Input Filter		3940	
Ventilation	-	By internal extract fans	
Airflow	m^3/h	22300	
Cable entry	-	Bottom (top optional)	
Colour	-	RAL 7035 (Light grey)	
Protection grade (with open/closed front doors).	-	IP 20	

Note: Dimensions and weight do not include the pallet and packing material. Actual weight will vary depending on installed options.

OPTION		
MAINTENANCE BYPASS CABINET *1+ 1 Configuration (two UPS's with parallel redundant connection)*		
Height	mm	1900
Width		1250
Depth		978
Weight	kg	400
Cable entry	-	Top and bottom
Colour	-	RAL 7035 (Light grey)
Protection grade	-	IP 20
Power isolators		SIRCO 4 poles 800A (at 400 Vca)

5.4 UPS Electrical Characteristics (Input Rectifier)

RECTIFIER INPUT MAINS		
	UNITS	
Rated power	**kVA**	**500 kVA (12 pulse)**
Rated mains voltage ❶	Vac	380 - **400** - 415 V
Supply		Three phase without neutral
Input voltage tolerance ❷	%	-15, +10
Frequency	Hz	**50** / 60
Input frequency tolerance	%	± 5
Rated input power ❸	kVA	518
		495 (with input harmonic filter 4%)
Rated input current ❸	A	748
		714 (with input harmonic filter 4%)
Maximal input power ❹	kVA	648
		619 (with input harmonic filter 4%)
Maximal input current ❹	A	935
		893 (with input harmonic filter 4%)
Duration of progressive power walk-in ❺	sec	2 or 10
Maximal output current	A	1000

Note:

❶= 380V or 415V set changing taps on auxiliary supply transformer.

❷= With mains at –15% and suggested battery elements the UPS maintains the output rated voltage at rated load but cannot guarantee float charge to battery; the battery does not discharge.

❸= EN 62040-3 (3.4.5): UPS , rated load, input rated voltage 400V, no current to battery.

❹= EN 62040-3 (3.4.6): UPS , rated load or overload, input rated voltage 400V, battery on boost charge with maximal allowed current.

❺= Set with jumper on Rectifier Control Board (slow or fast).

5.5 UPS Electrical Characteristics (DC Intermediate Circuit)

DC INTERMEDIATE CIRCUIT		
	UNITS	
Rated power	**kVA**	**500 kVA (12 pulse)**
Voltage range for inverter operation	Vdc	385 – 610
Recommended number of lead-acid cells ❶-❷	No	228 (380Va. c.) **240 (400V a. c.)** 252 (415Va. c.)
Recommended float charge voltage 2.25 V/el. ❶	Vdc	513 (380V a. c.) **540 (400V a. c.)** 567 (415Va. c.)
Recommended boost charge voltage 2.40 V/el. ❶	Vdc	547 (380Va. c.) **576 (400V a. c.)** 605 (415Va. c.)
Recommended end of discharge voltage 1.67 V/el. ❶	Vdc	381 (380Va. c.) **401 (400V a. c.)** 421 (415Va. c.)
Recommended test voltage 1.90 V/el. ❶	Vdc	433 (380Va. c.) **456 (400V a. c.)** 479 (415Va. c.)
Maximum voltage on manual charge 2.45 V/el. ❶	Vdc	559 (380Va. c.) **588 (400V a. c.)** 617 (415Va. c.)
Maximum recharge battery current	A	200
Battery boost charge cycle ❸	-	Characteristics to DIN 41772 I-U, boost to floating charge switching, with current measuring criterion plus control of charging time
Maximum boost charge duration ❸	min	0-999
Boost-float threshold current ❸	A	0-99
Temperature voltage compensation ❹	mV/°C	2
Ripple voltage superimposed ❺	%	≤1

Note:

❶= (According to rated voltage).

❷= factory set for rated 400 V, different cells number and voltage per cell may be set by software and/or trimmers on Rectifier Control Board.

❸= Set by software.

❹= With external temperature sensor, feature selected on Rectifier Control Board.

❺= Battery disconnected, RMS percentage value referred to DC voltage.

5.6 UPS Electrical Characteristics (Inverter Output)

INVERTER OUTPUT		
	UNITS	
Rated power	**kVA**	**500 kVA (12 pulse)**
Rated mains voltage ❶	Vac	380 - **400** - 415
Supply		Three phase with neutral
Frequency ❷	Hz	**50** / 60
Rated Power at cos φ = 0.8	kVA	500
Rated Power at cos φ = 1	kW	400
Three -phase transient overload ❸	%	110 for 60 minutes 125 for 10 minutes 150 for 1 minute
Single -phase transient overload	sec I/In	30 2.90
Maximal non linear load allowed ❹		100% Pn
Voltage stability, steady state test ❺	%	± 1
Voltage stability, transient test ❻	%	± 5
Maximum rate of change of frequency ❼	Hz/sec	0.1
Current rating of neutral cable ❽	A	800 (1) 1250 (2)

Note:

❶= Factory set 400V — 380 or 415 voltages with software setting.

❷= Factory set at 50Hz; 60 Hz with software setting.

❸= EN 62040-3 (3.5.8).

❹= EN 62040-3 (3.4.14 and annex E) crest factor 3.

❺= EN 62040-3 (6.3.4).

❻= EN 62040-3 (6.3.7) also for 0-100-0%, load transient, restore time 20 ms to ±1%.

❼= Factory set at 0.1Hz/sec; 0.5 to 1 Hz/sec with software setting for UPS single module.

❽= (1) refers to the sizing of the UPS power isolators (cut-off neutral).
(2) optional kit to uprate the neutral cut-off current rating where local regulations permit.

5.7 UPS Electrical Characteristics (Bypass Input Mains)

BYPASS INPUT										
	UNITS									
Rated power	**kVA**	**500 kVA (12 pulse)**								
Rated mains voltage❶	Vac	380 - **400** - 415 V								
Supply		Three phase with neutral								
Rated Current: 380Vac 400Vac 415Vac	A	 783 744 717 (*) load assumed @ P.F. = 0.8								
Bypass voltage tolerance ❷	%	± 10								
Delay time to recognise bypass voltage returned to window	sec	10								
Inverter output voltage window	%	± 10								
Frequency ❸	Hz	**50** \ 60								
Input frequency tolerance ❹	%	± 2								
Maximum frequency slew rate	Hz/sec	0.1								
Current rating of neutral cable ❺	A	800 (1) 1250 (2)								
Protection, bypass line		To avoid series fuses, the bypass line should be protected using an external device in the input distribution system. This device should be sized to discriminate with the load protection.								
Transient overload	ms I/In	10 14.3	20 12.6	50 11.0	100 10.0	200 9.0	500 8.0	1000 7.1	2000 6.6	5000 5.7

Note:

❶= Factory set 400V — 380 or 415 set changing taps on auxiliary supply transformer and with software setting.

❷= Other values 0 –15% with software setting.

❸= Factory set at 50Hz; 60 Hz with software setting.

❹= Other values 1 – 9 % with software setting.

❺= (1) refers to the sizing of the UPS power isolators (cut-off neutral).
(2) optional kit to uprate the neutral cut-off current rating where local regulations permit.

5.8 UPS Electrical Characteristics (System Performance)

SYSTEM PERFORMANCE		
	UNITS	**500 kVA (12 pulse)**
Rated power	**kVA**	
AC/AC Efficiency at load 25%	%	90
		89.8 with Input Filter (4%)
AC/AC Efficiency at load 50%		92.8
		92.6 with Input Filter (4%)
AC/AC Efficiency at load 75%		92.8
		92.6 with Input Filter (4%)
AC/AC Efficiency at load 100%		92.0
		91.8 with Input Filter (4%)
ECOMODE		97.1

5.8.1 Losses

LOSSES		
	UNITS	**500 kVA (12 pulse)**
Rated power	**kVA**	
No load losses	kW	10
		10.1 with Input Filter (4%)
Losses at load 25%		11.11
		11.36 with Input Filter (4%)
Losses at load 50%		15.52
		15.98 with Input Filter (4%)
Losses at load 75%		23.28
		23.97 with Input Filter (4%)
Losses at load 100%		34.78
		35.73 with Input Filter (4%)
ECOMODE		12.2

This page is left blank intentionally

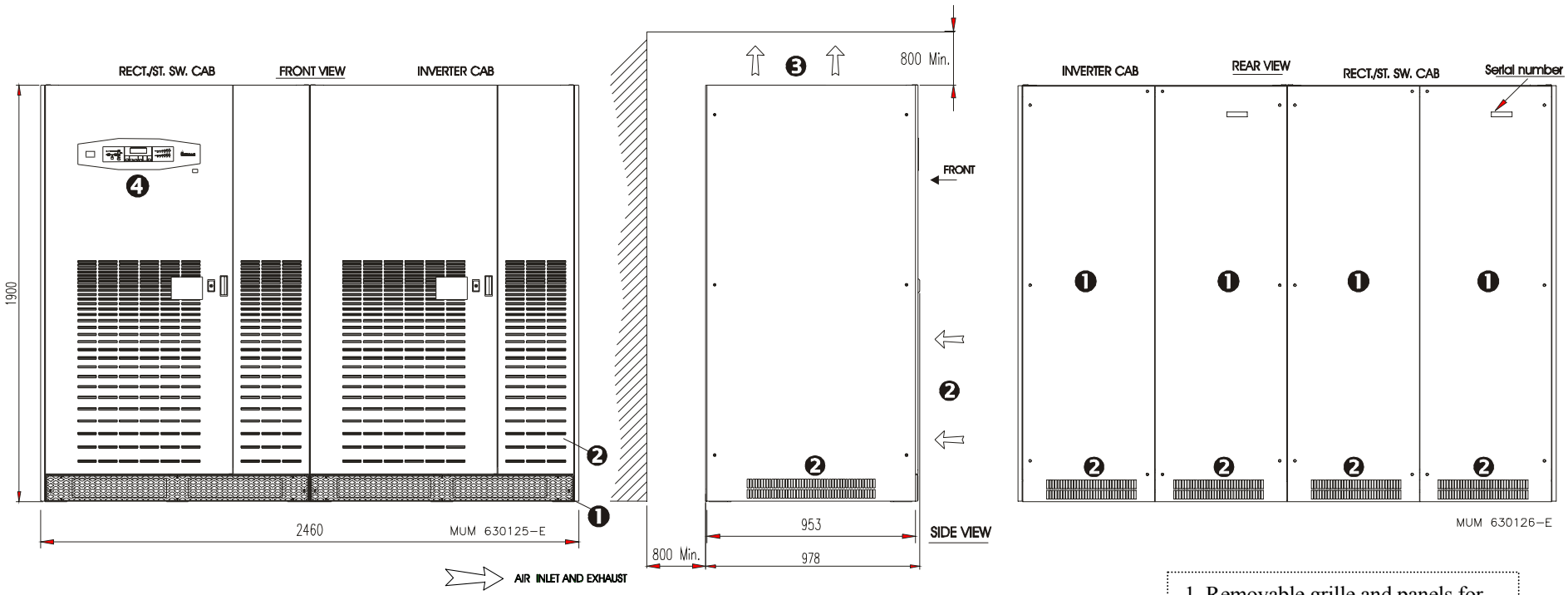
6 Chapter 6 - Installation Drawings

6.1 Introduction

The drawings below illustrate the principal mechanical and electrical characteristics of the Liebert Hipulse E and of its various optional cabinets.

In these drawings you will find all information of use for positioning the equipment, determining cable entry, making electrical power and auxiliary connections, determining the position of isolators, determining the physical location of various optional equipment, etc.

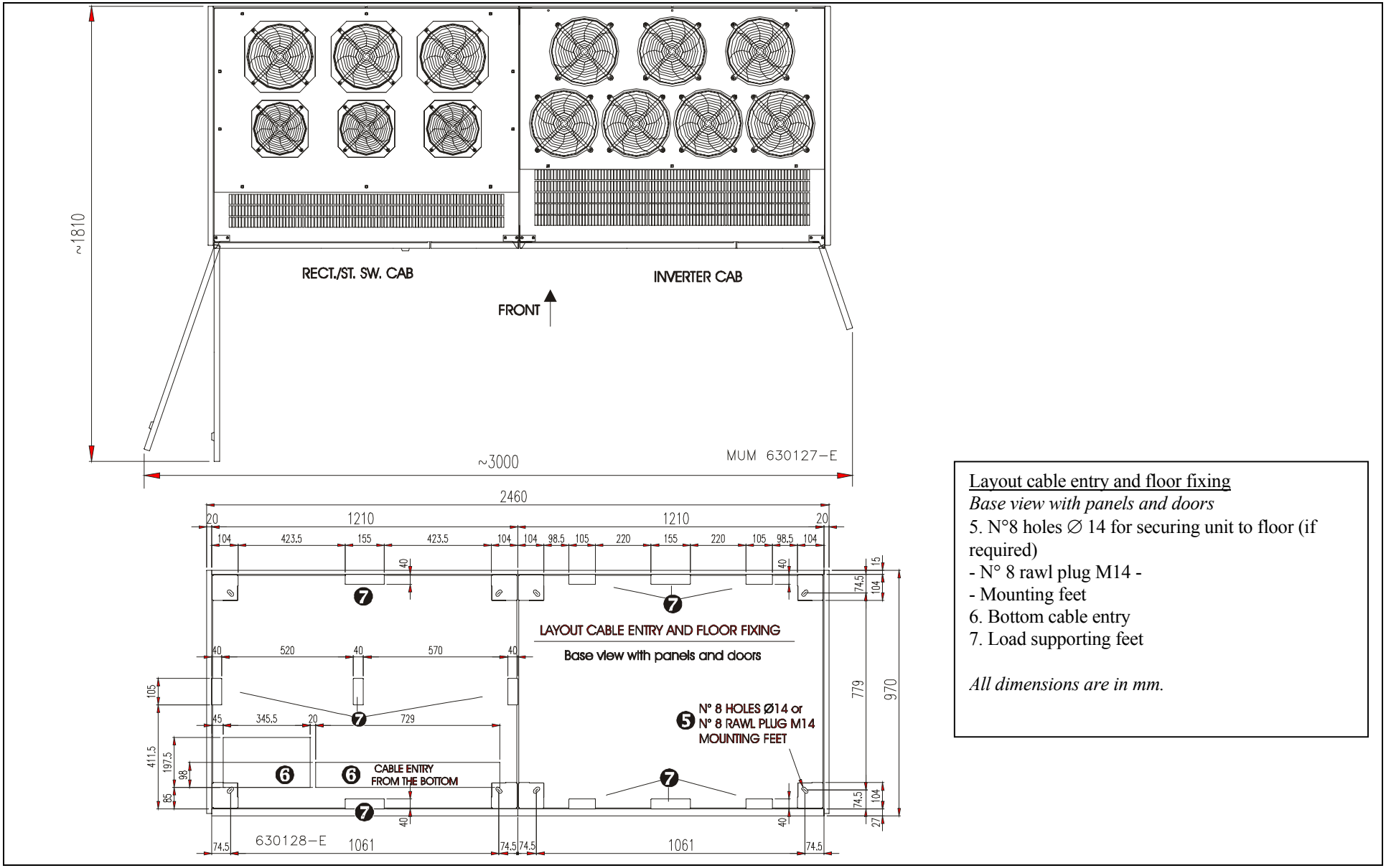
6.1.1 500kVA UPS Module with 12 pulse rectifier – general view



1. Removable grille and panels for lifting with fork-lift truck.
2. Air inlet grille
3. Air exhaust
- 800 mm min. clearance above unit required for air exhaust.
4. Operator control and display panel

All dimensions are in mm.

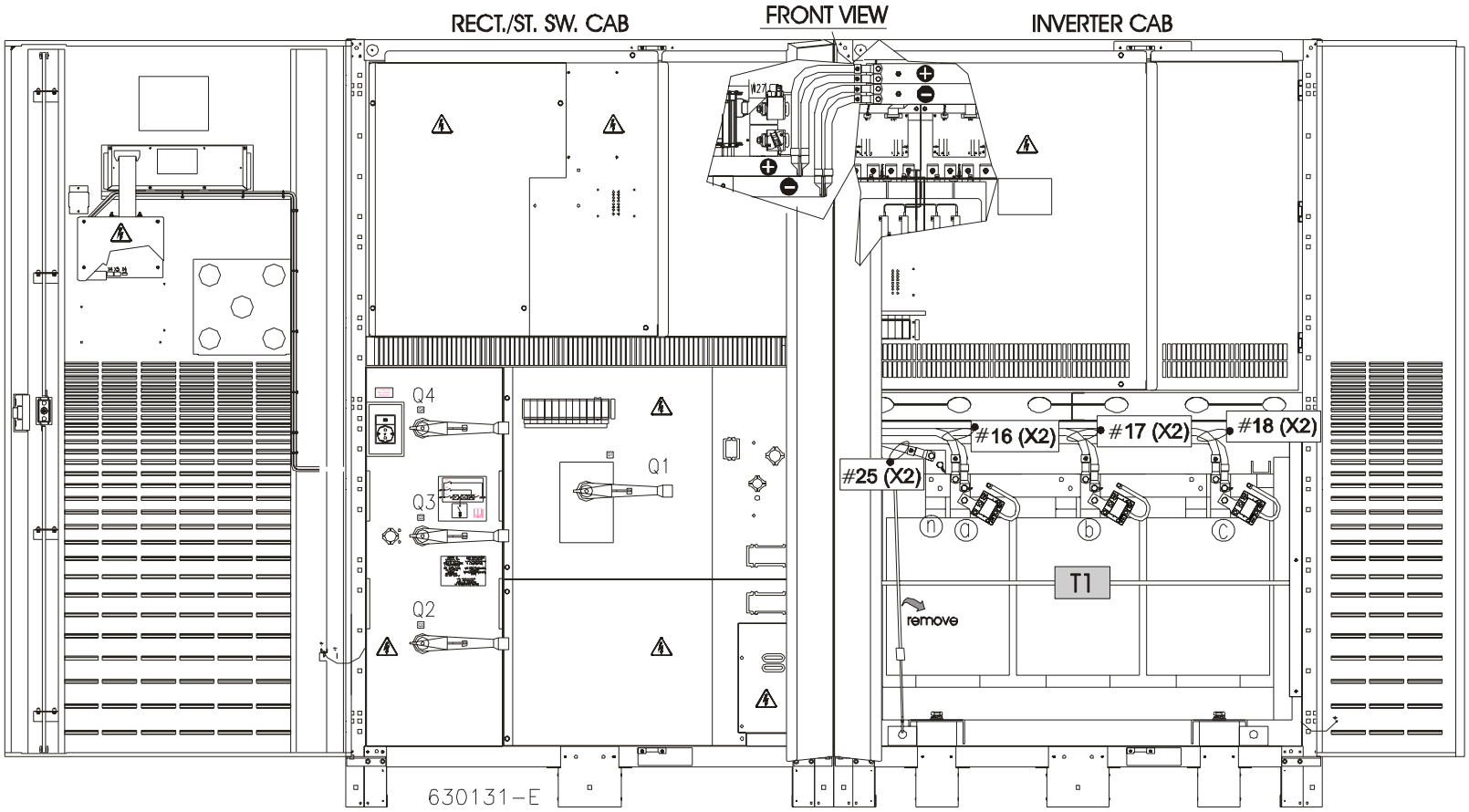
6.1.2 Base & top view for 500kVA UPS Module with 12 pulse rectifier



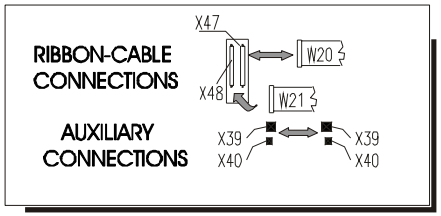
Layout cable entry and floor fixing
Base view with panels and doors
5. N°8 holes ∅ 14 for securing unit to floor (if required)
- N° 8 rawl plug M14 -
- Mounting feet
6. Bottom cable entry
7. Load supporting feet

All dimensions are in mm.

6.1.3 View of auxiliary, control signals and power connections between the 500 kVA UPS cabinets



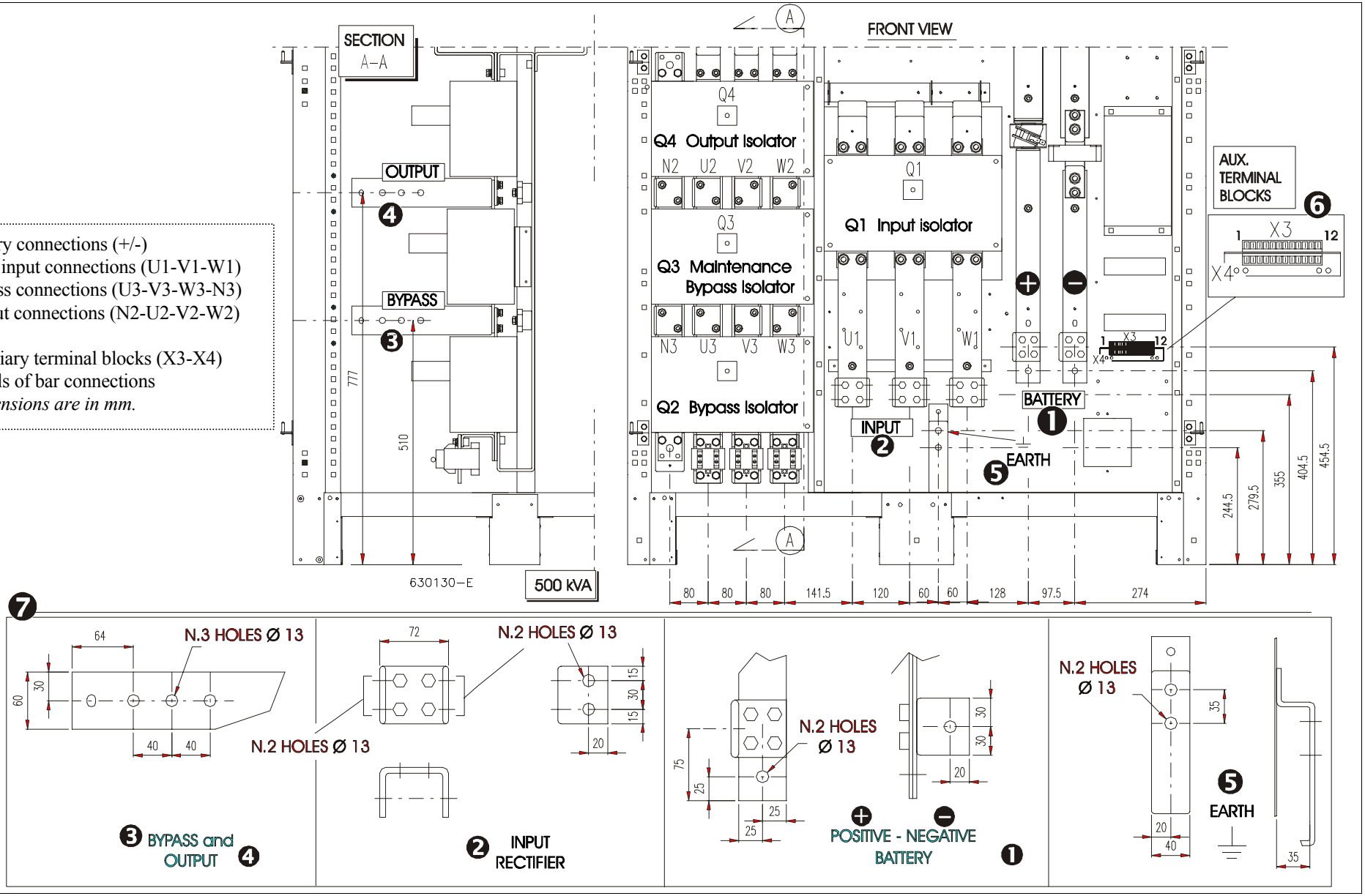
Q.ty Cables	From RECTIFIER - ST.SW. cab.		To INVERTER cab.
2	# 25	>>	n
2	# 16	>>	a
2	# 17	>>	b
2	# 18	>>	c
4	# 31A +	>>	+
4	# 30 A −	>>	−
	X39	<<	X39
	X40	<<	X40
	X47	<<	W20
	X48	<<	W21



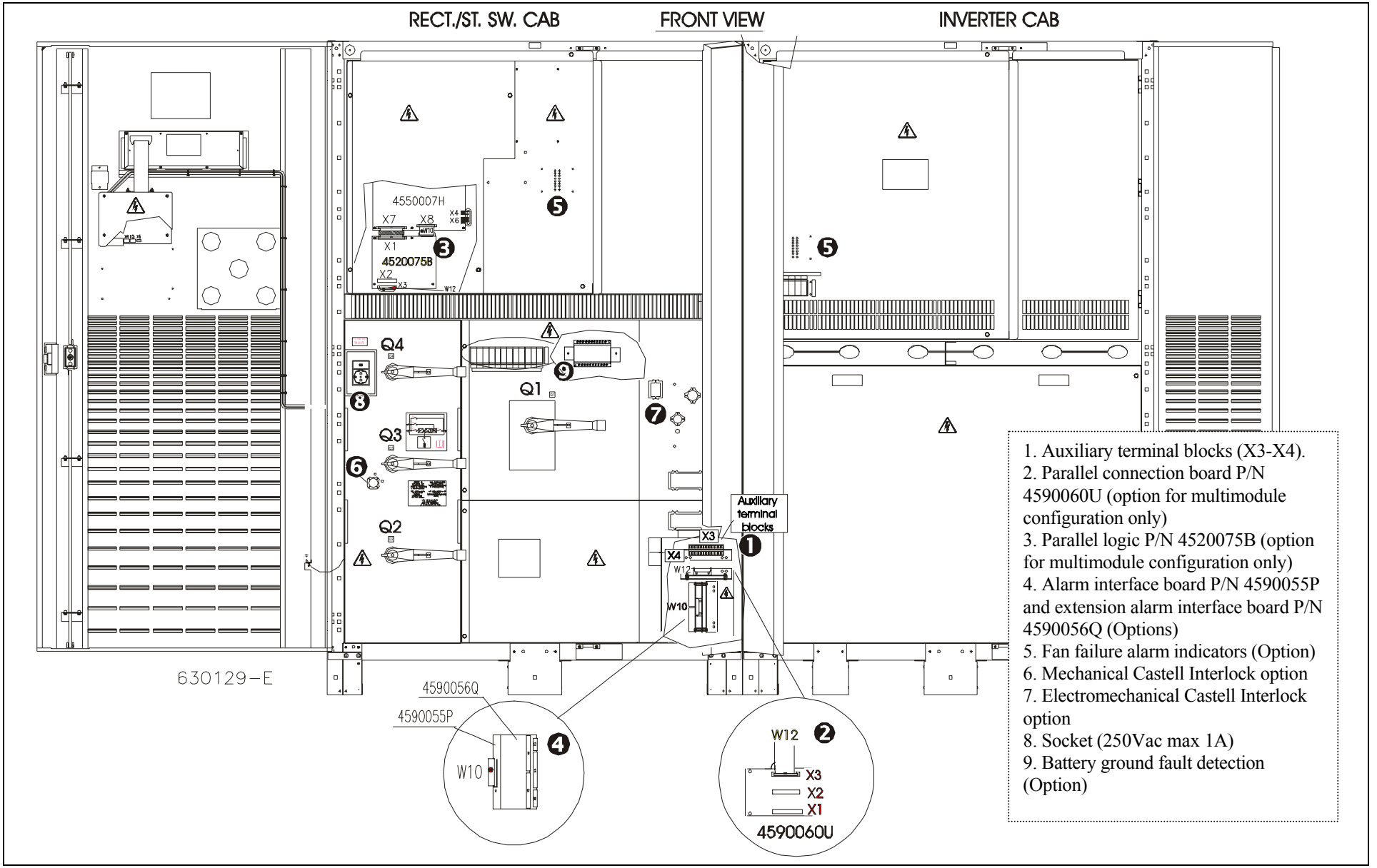
6.1.4 Cable connections for 500 kVA UPS (Rectifier /Static switch cabinet)

1. Battery connections (+/-)
2. Main input connections (U1-V1-W1)
3. Bypass connections (U3-V3-W3-N3)
4. Output connections (N2-U2-V2-W2)
5. Earth
6. Auxiliary terminal blocks (X3-X4)
7. Details of bar connections

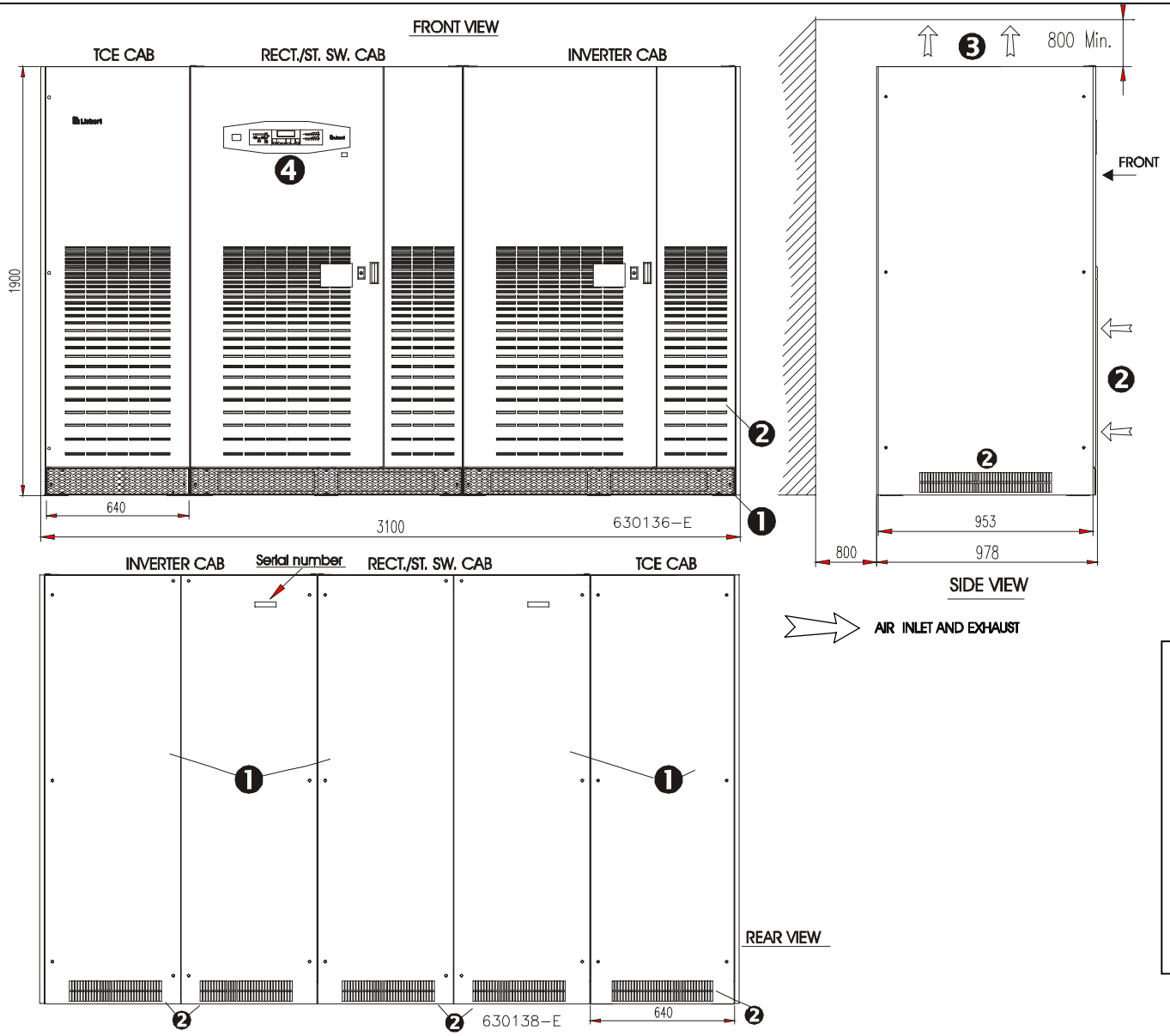
All dimensions are in mm.



6.1.5 500kVA UPS Module with 12 pulse rectifier – Front view with open doors



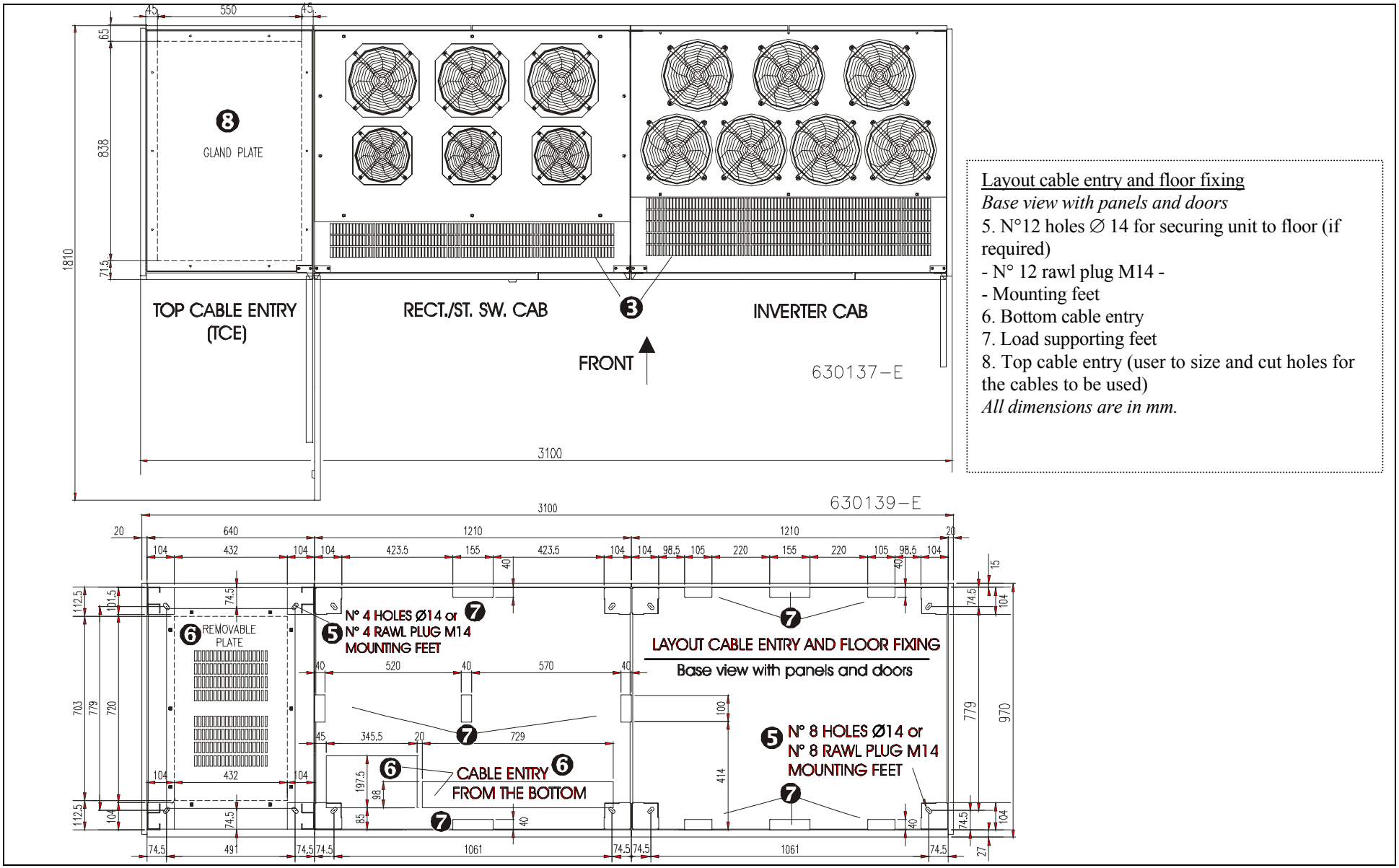
6.1.6 500kVA UPS Module 12 pulse rectifier with Top Cable entry option



1. Removable grille and panels for lifting with fork-lift truck.
2. Air inlet grille
3. Air exhaust
- 800 mm min. clearance above unit required for air exhaust.
4. Operator control and display panel

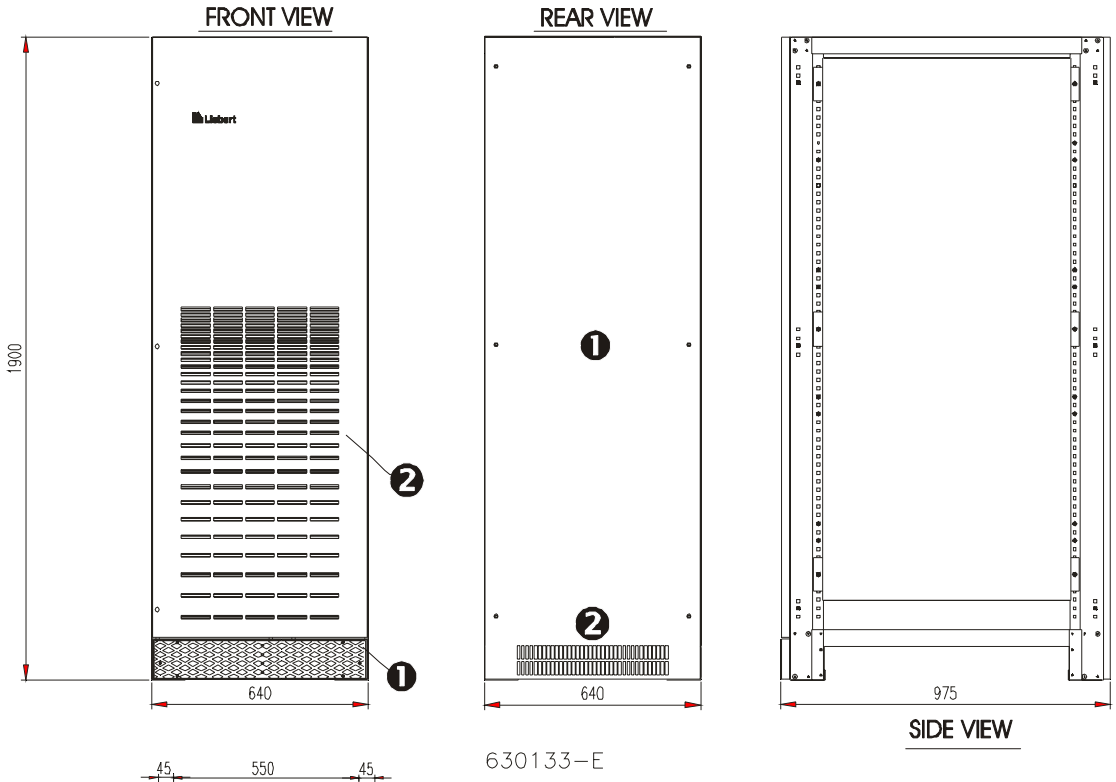
All dimensions are in mm.

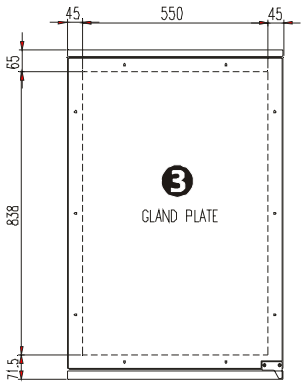
6.1.7 Base & top view for 500kVA UPS Module 12 pulse rectifier with Top Cable entry option



Layout cable entry and floor fixing
Base view with panels and doors
5. N°12 holes ∅ 14 for securing unit to floor (if required)
- N° 12 rawl plug M14 -
- Mounting feet
6. Bottom cable entry
7. Load supporting feet
8. Top cable entry (user to size and cut holes for the cables to be used)
All dimensions are in mm.

6.1.8 Top Cable entry option – general view

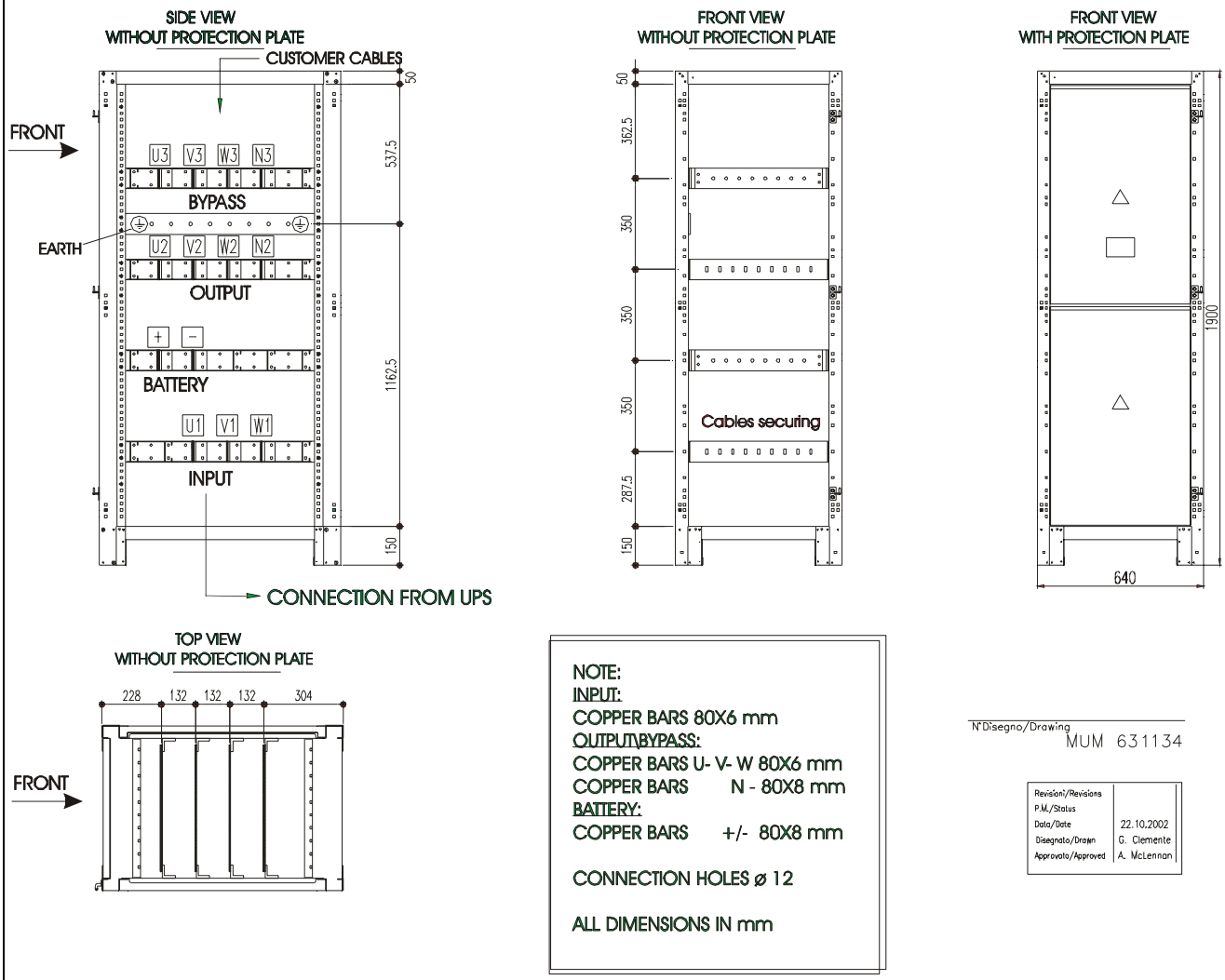




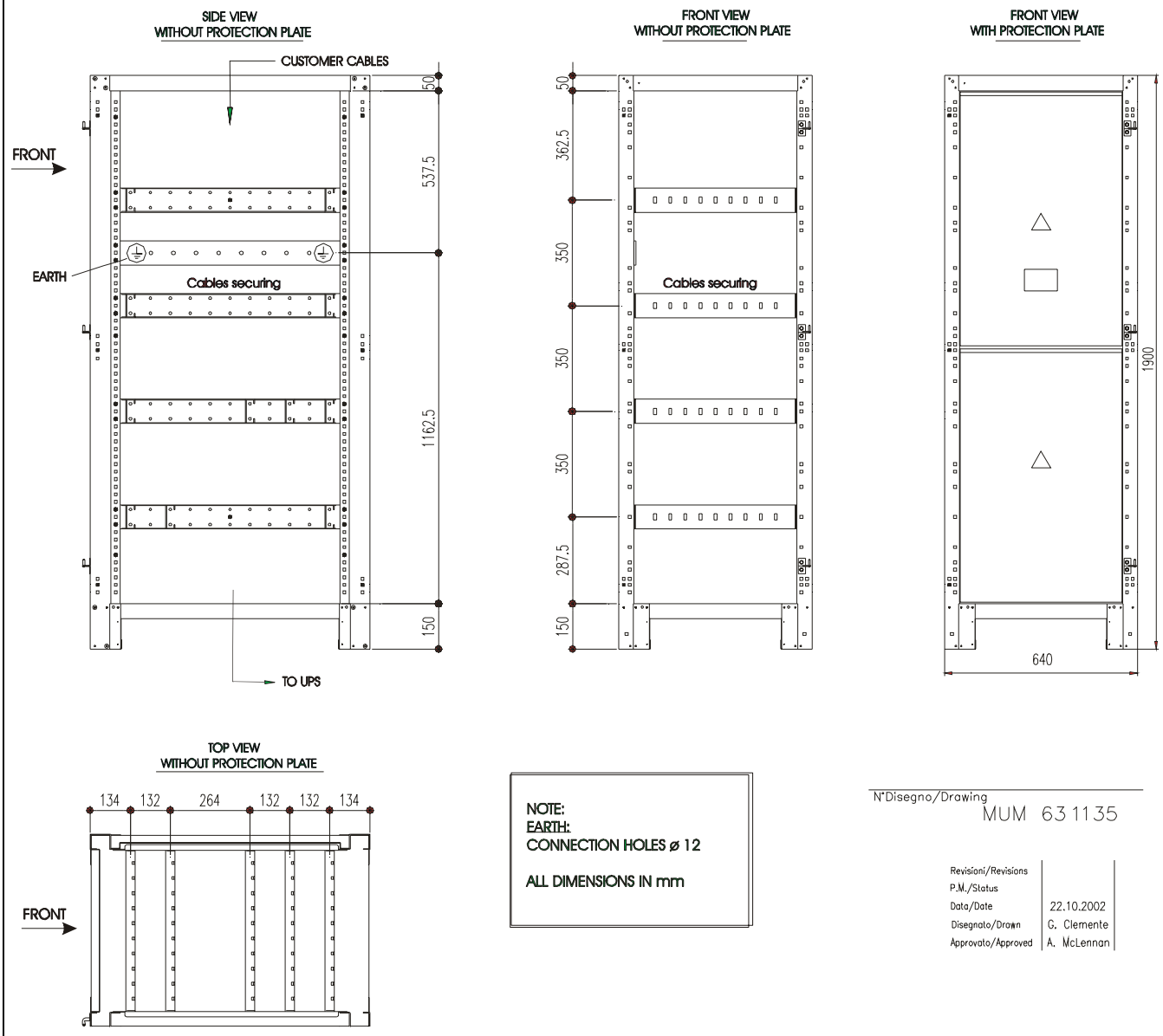
1. Removable grille and panels for lifting with fork-lift truck.
2. Air inlet grille
3. Top cable entry (user to size and cut holes for the cables to be used)

All dimensions are in mm.

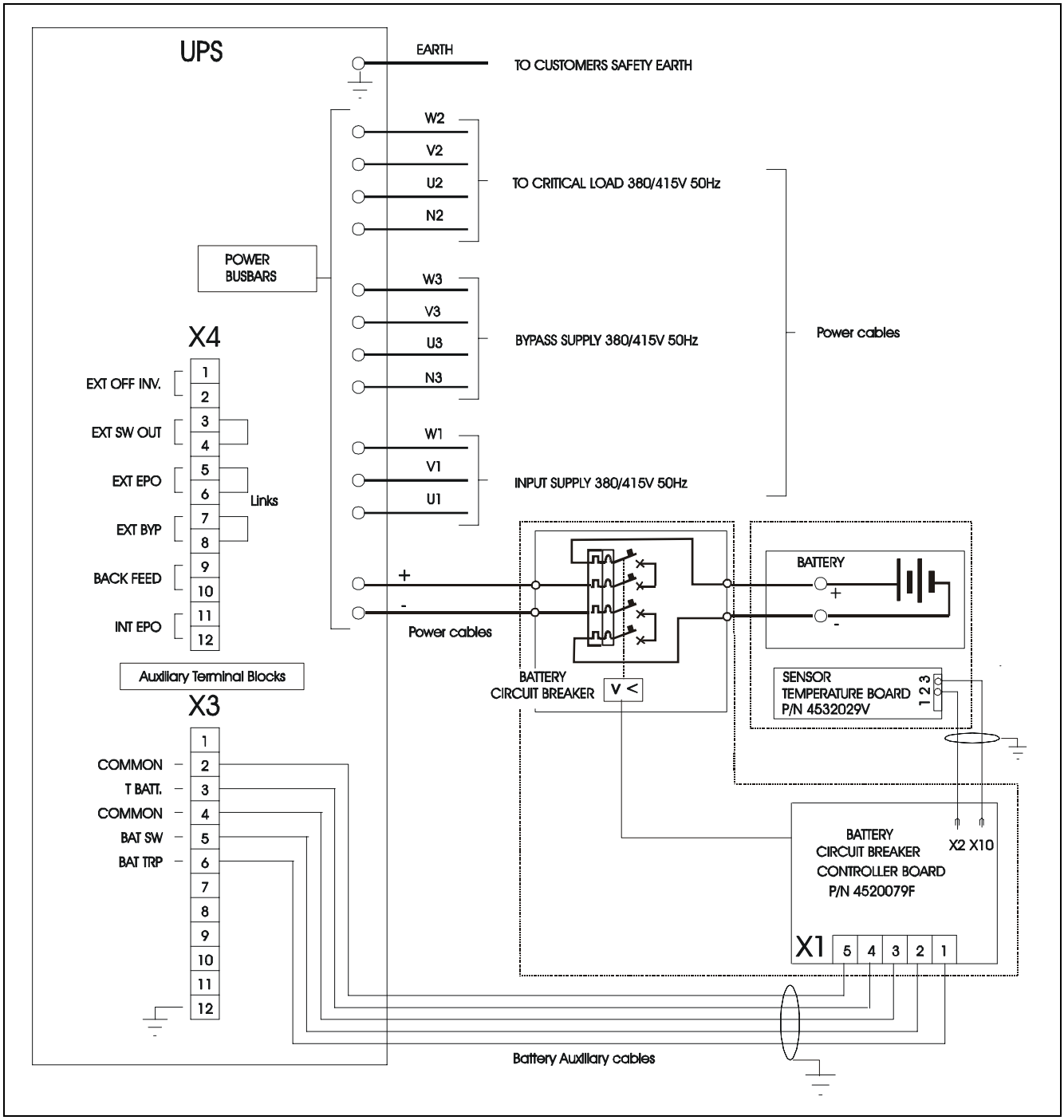
6.1.9 Top Cable entry option – with connection bars



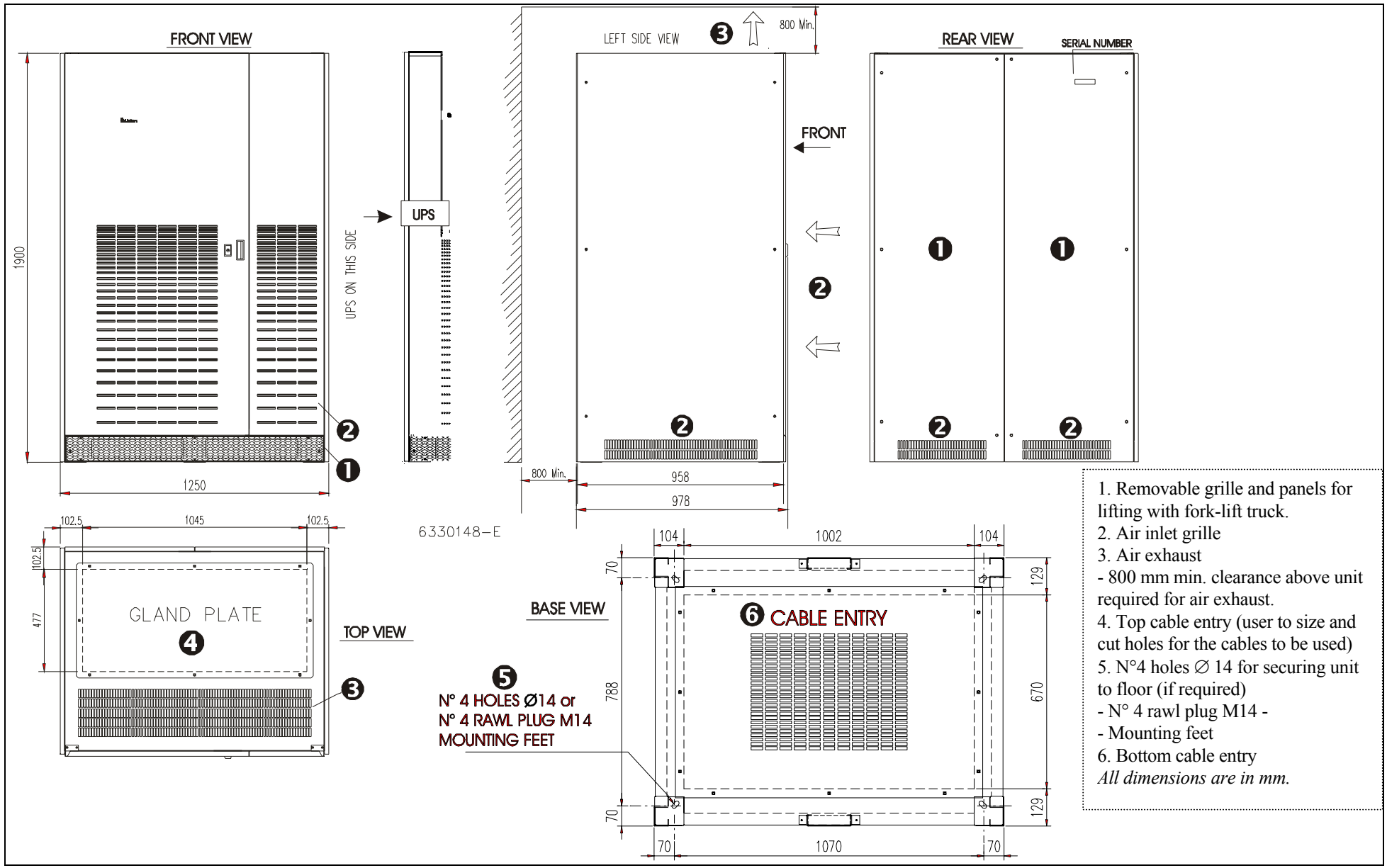
6.1.10 Top Cable entry option – without connection bars



6.1.11 Cable connections for 500 kVA UPS with Battery Circuit Breaker



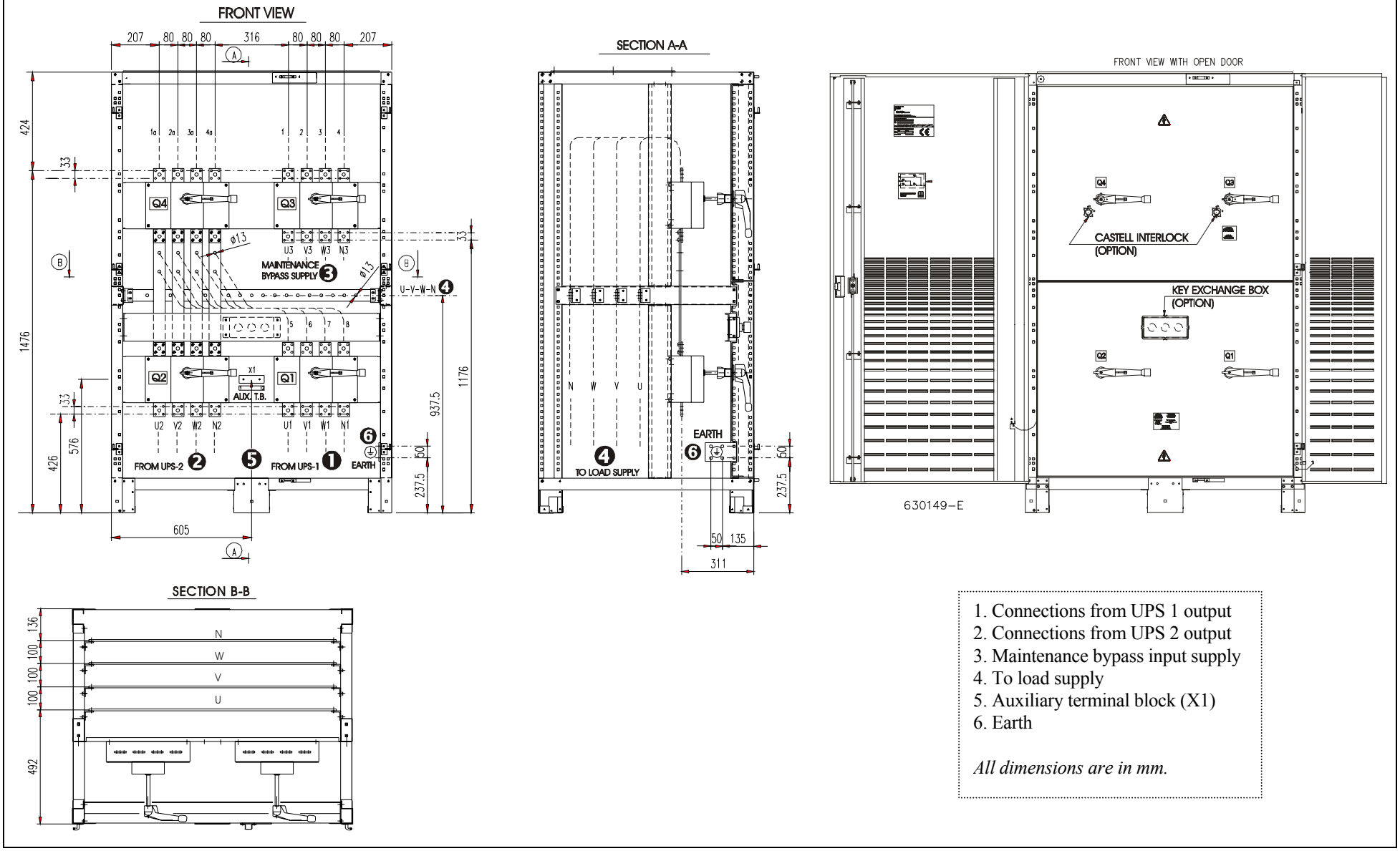
6.1.12 Maintenance Bypass cabinet (Option) – general view



1. Removable grille and panels for lifting with fork-lift truck.
2. Air inlet grille
3. Air exhaust
- 800 mm min. clearance above unit required for air exhaust.
4. Top cable entry (user to size and cut holes for the cables to be used)
5. N°4 holes ∅ 14 for securing unit to floor (if required)
- N° 4 rawl plug M14 -
- Mounting feet
6. Bottom cable entry

All dimensions are in mm.

6.1.13 Maintenance Bypass cabinet (Option) – Front view with open doors



1. Connections from UPS 1 output
2. Connections from UPS 2 output
3. Maintenance bypass input supply
4. To load supply
5. Auxiliary terminal block (X1)
6. Earth

All dimensions are in mm.

Part II – User Manual

7 Chapter 7 - General Description

7.1 Introduction

The Liebert Hipulse E Uninterruptible Power Supply (UPS) System is connected between a critical load, such as a computer, and its three phase mains power supply. Being designed to furnish a well regulated 3 phase output power supply under all rated load and input supply conditions, the system offers the user the following advantages:

Increased power quality:

The UPS has its own internal voltage and frequency regulators which ensure that its output is maintained within close tolerances independent of voltage and frequency variations on the mains power lines.

Increased noise rejection:

By rectifying the input a.c. power to d.c. power, and then converting it back to a.c., any electrical noise present on the input mains supply line is effectively isolated from the UPS output, therefore the critical load sees only clean power.

Power blackout protection:

If the mains power fails, the UPS continues to power the critical load from its battery source, leaving the load immune from power disturbances.

7.2 Design Concept

7.2.1 Introduction

This section describes an individual module's operating principles. The UPS basically operates as an a.c. -d.c. -a.c. converter (see figure 7-1). The first conversion stage (from a.c. to d.c.) uses a 3 phase, fully-controlled SCR bridge rectifier to convert the incoming mains supply into a regulated d.c. bus-bar.

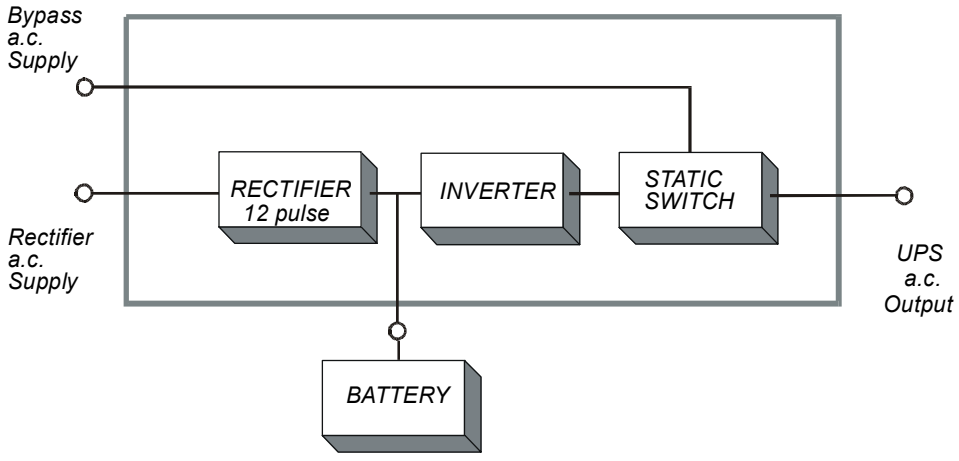


Figure 7-1 Single Module block diagram

The d.c. bus-bar produced by the rectifier provides both battery charging power - being equipped with a temperature compensated battery charging system, to prolong battery life - and power to the inverter section – which utilizes the latest IGBT switching pulse width modulation (PWM) design - and provides the second conversion phase, i.e. reconverting the d.c. bus-bar voltage back into an a.c. voltage waveform.

During normal operation both the rectifier and inverter sections are active and provide regulated load power whilst simultaneously float charging the battery. In the event of a mains power failure, the rectifier becomes inoperative and the inverter is powered solely from the battery. Critical load power is maintained under these conditions until the battery is fully discharged, whereupon the UPS shuts down. The end of battery discharge is assumed when the battery voltage falls below a preset value (i.e. 401V d.c. for a 400V a.c. system).
The period for which the load can be maintained following a mains power failure is known as the system's ‘Autonomy Time' and is dependent upon both the battery A/Hr capacity and the applied percentage load.

7.2.2 Bypass supplies

The circuit block annotated ‘Static Switch' in figure 7-2 contains an electronically controlled switching circuit which enables the critical load to be connected either to the inverter output or to a bypass power source via the `static bypass line'. During normal system operation the load is connected to the inverter and the 'inverter-side' of the Static Switch is closed; but in the event of a UPS overload, or inverter failure, it is automatically transferred to the static bypass line.

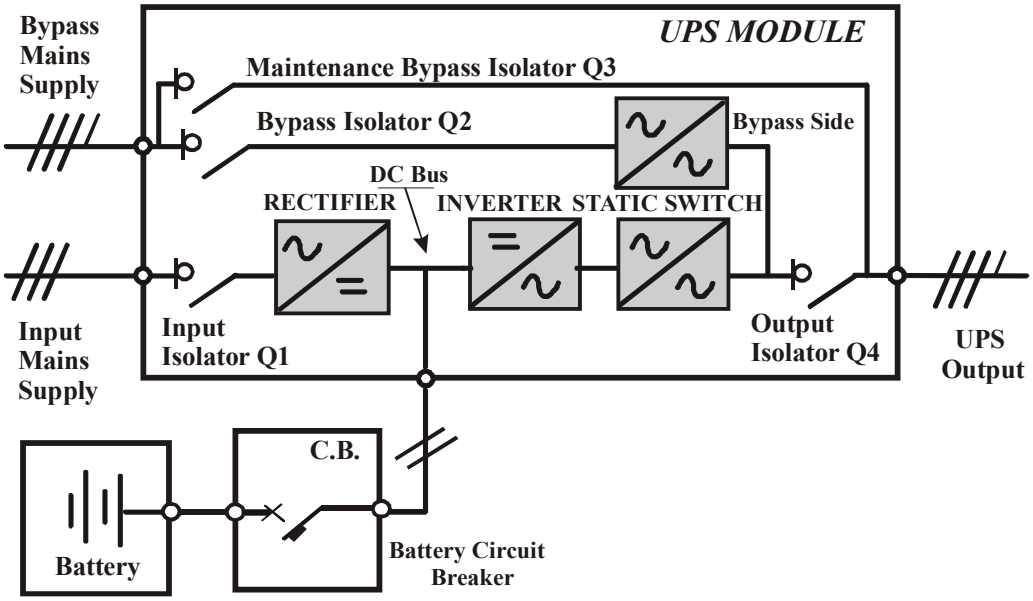


Figure 7-2 UPS power switches configuration

To provide a clean (no-break) load transfer between the inverter output and static bypass line, the static switch activates connecting the load to the bypass supplies. To achieve this, the inverter output and bypass supply must be fully synchronized during normal operating conditions. This is achieved through the inverter control electronics which make the inverter frequency track that of the static bypass supply provided that the bypass remains within an acceptable frequency window. The synchronizing window is pre-selected to 2% of nominal frequency, giving an acceptable frequency window ±1 Hz.

A manually controlled, `maintenance bypass' supply is also incorporated into the UPS design. Its purpose is to enable the critical load to be powered from the mains (bypass) supply while the UPS is shut down for routine maintenance.

Note: The load equipment is not protected from normal supply aberrations when operating on Bypass side or in the maintenance bypass mode

7.2.3 System Control Philosophy

Normal operation

During normal operation, i.e. when the UPS input supply is present and within specification, both the rectifier and inverter sections are active and the static switch is turned on to connect the inverter output to the critical load busbars. The battery circuit breaker is also closed and the battery is therefore permanently float charged at the d.c. busbar voltage level.

(1+N Parallel UPS System) *Note:* As the unit outputs are connected in parallel, the System checks that the inverter control circuits are perfectly synchronised with one another and with the Bypass Mains in terms of both frequency and phase and that they have the same output voltages. Current supplied to the load is automatically divided among UPSs. A warning message appears while synchronisation is in progress.

A module's static switch cannot close until these conditions are satisfied

Mains Failure

If the power mains has a failure or is out of tolerance the rectifier will stop automatically, while the Inverter will continue to operate on power from the battery for a period of time which depends on the load and the capacity of the battery. If the mains supply has not returned within this time, the Inverter will stop automatically and an alarm message will appear on the UPS operator control panel display.
Critical load will not be interrupted in the event of a drop or return of the AC power mains.

Return of power mains

When the mains returns within the required tolerance, the Rectifier will start up again automatically and gradually (power walk-in), supplying power to the Inverter and recharging the battery at the same time. There will be no interruption of the critical load.

Input Power Walk-in

The rectifier/charger provides a feature that limits the total initial power requirements to 20% of rated load and gradually increases power up to 100% of full rating over an hardware selectable time (slow or fast).

Off-Battery

If the battery system only is taken out of service for maintenance, it is disconnected from the rectifier/charger and inverters by means of (an) external disconnect breaker(s). The UPS shall continue to function and meet all of the specified steady-state performance criteria, except for the power outage back-up time capability.

Power Walk-in delay timer

On 1+N parallel systems, it is possible to select the start of each UPS after a power failure, by setting a suitable time from the operator's display (ranging between 0 and 120 seconds). This function is particularly useful when a generator is present on the input side because it enables to acquire power gradually.

UPS Module fault

In the event of an Inverter fault, the Static Transfer Switch will automatically transfer the load onto the Bypass Mains with no interruption. In such an event, request qualified technical assistance.
(1+N Parallel UPS System) In the event of a fault in a unit, the unit's Static Transfer Switch will automatically exclude the unit from the system. If the system is still capable of providing the required load, the remaining units will continue to supply the load with no interruption. When the units still present in the system are no longer capable of fulfilling power requirements, the load will automatically be transferred onto the bypass mains. The load will be transferred with no interruption if the Inverters are synchronised with the network; if this is not the case, there will be an interruption lasting about 20 msec.

Overload

In the event of an overload at the Inverter output which lasts longer than the typical time/current (refer to Installation Manual – Specifications), the Inverter will shut down and the Static Transfer Switch will automatically transfer the load onto the bypass mains with no interruption. If the overload falls within the typical time/current that has been specified, the load will be returned to the inverters when the power drops to a level which can be supported by the number of active units in the system (parallel 1+N).
In the event of a short circuit in the output, the load will normally be transferred onto the bypass mains, which will cause the Inverter to shut down; this switch is determined above all by the features of the protective devices in use in the system.
In either case, an alarm message will appear on the UPS operator control panel display.

(1+N Parallel UPS System) The control logic system constantly monitors load requirements and controls the power supplied by the UPS modules. In the event that an overload condition is sustained for greater than a preset time, the load will transfer to the mains bypass supply, when the number of active modules are unable to satisfy load

requirements. The load returns to the inverter supply if the power is reduced to a value that can be sustained by the number of active modules in the system.

Maintenance Bypass

A second bypass circuit contained in the UPS cabinet, identified as the 'Maintenance Bypass' line is included to enable a 'raw' mains supply to be made available to the load while facilitating a safe working environment for carrying out scheduled UPS system maintenance or trouble shooting. The circuit is manually selected by the Maintenance Bypass Isolator which can be padlocked in the OFF position.

WARNING

The internal maintenance bypass must not be used when the UPS system is comprised of ***more than two UPS*** *modules in parallel.*

CAUTION: *If an automatic circuit breaking device is not present in the input distribution panel, there remains a dangerously high voltage at the output busbars and also on the input busbars of the UPS module that is switched off*

7.2.4 ECOMODE *(for single UPS only)*

In this operating mode the System prefers to put the load on the Bypass Mains, with the Inverter on stand-by. The load is switched over to the Inverter when the mains goes outside of standard frequency and voltage values (or the values as modified using the operator panel when starting up the system). The ECOMODE configuration requires a different set-up in the default menu configuration, which may be prepared in the factory before shipment or during installation by personnel trained in use of the System.

Note: In order to operate in ECOMODE, UPSs must be provided with compatible software versions:
The 'UPS Logic' card must be **release 15.0** or later (the SW release of the cards may be read on the front panel display, referring to Section 8.1.2 — Operating Instructions).
Operating procedures in ECOMODE are the same as those described in Chapter 9, except that the load is normally on the Bypass Mains, the Load led is normally on Inverter (5), and the corresponding alarm message will be replaced with Load on Mains (6).

WARNING

In ECOMODE the load is not protected against mains distortion.

7.2.5 UPS Power Switch Configuration

Figure 7-2 illustrates the Liebert Hipulse E UPS module in what is known as the *"Split Bypass"* configuration. In the *"Split Bypass"* configuration the static bypass line is connected by a separate power switch to a dedicated `bypass' power source which also feeds the maintenance bypass line. Where a separate power source is not available the Bypass (Q2) and Rectifier input supply connections would be linked together.

With the exception of the maintenance bypass isolator, all the isolators shown must be closed during normal UPS operation.

7.2.6 Battery circuit breaker

The battery should be connected to the d.c. busbar through a circuit breaker fitted inside the battery cabinet –or located adjacent to the batteries where a battery cabinet is not used. This circuit breaker is closed manually, but it contains an undervoltage release coil which enables it to be tripped from the UPS control electronics following certain detected faults. It also has a magnetic trip facility for overload protection.

7.2.7 Battery temperature compensation

Liebert Hipulse E UPS System offers a battery temperature compensation circuit. As the temperature at the battery location rises the d.c. busbar voltage reduces in order to sustain the battery at its optimum charge voltage. This must be used in conjunction with the battery temperature sensor board.

7.2.8 Socket outlet

Socket outlet of 1A current 250 Vca (max) handling capability is provided for the ease of testing, commissioning & servicing of the UPS.

7.2.9 System Expansion

If necessary, a single-module system can be expanded to cater for an increased load requirement by adding additional modules. Such forward planning should also take into account the physical space required by any additional UPS modules, because any such modules must be situated adjacent to the existing system. System expansion requires a change in the SETUP of the display panel.

Note: System expansion should be carried out only by trained service personal.
The individual modules connected to the system must be of the same power rating.

7.2.10 Frequency Converter

Liebert Hipulse E is designed to function with the output AC to your critical load, supplied at a different frequency to the input mains.
The following frequency conversions are available:

1. 50 Hz input 60 Hz output
2. 60 Hz input 50 Hz output

When operating a single module as frequency converter the Liebert Hipulse E requires the static bypass operation to be disabled and isolation of the input mains supply from your critical load. These modifications will be carried out by the setting of internal links to inhibit the static switch operation, and isolation of the supply to the bypass isolator. As a bypass is not required, it is easier to implement a frequency converter application by using a Multi Module Unit version (MMU) Liebert Hipulse E module (see Figure 7-1). For requirements with different operating voltages the solution is to use a standard MMU module with external adapter auto-transformer.

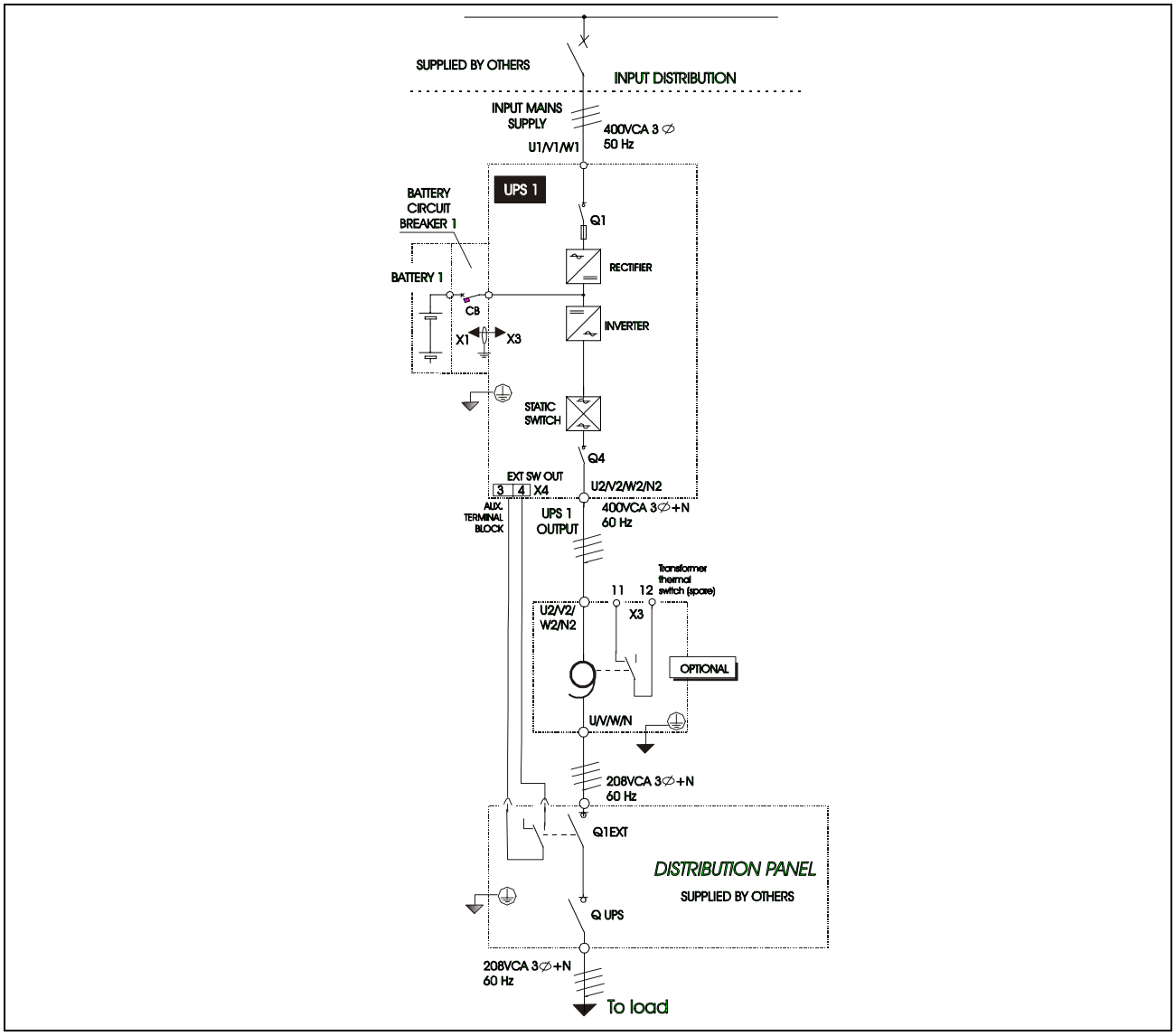


Figure 7-1 Example of frequency converter application

This page is left blank intentionally

8 Chapter 8 - Operator Control and Display Panel

8.1 Introduction

On the front of the UPS there is a display and control panel, from which it is possible to easily verify the status of the UPS including all the measured parameters and alarms of the UPS and battery discharge status. The operator control panel is divided into three functional areas:
* - 'mimic LED display' and Inverter control switch
* - 'operator panel '&'LCD display'
* - 'bargraph section'
As can be seen the left section consists of LEDs which indicate the operational and alarm status of the system by turning ON or OFF or by flashing ON/OFF.
The middle section of the operator control and display panel consists of a LCD (Liquid Crystal Display) and its associated switches.
The following functional area (right section) shows the various UPS load and battery charging conditions.

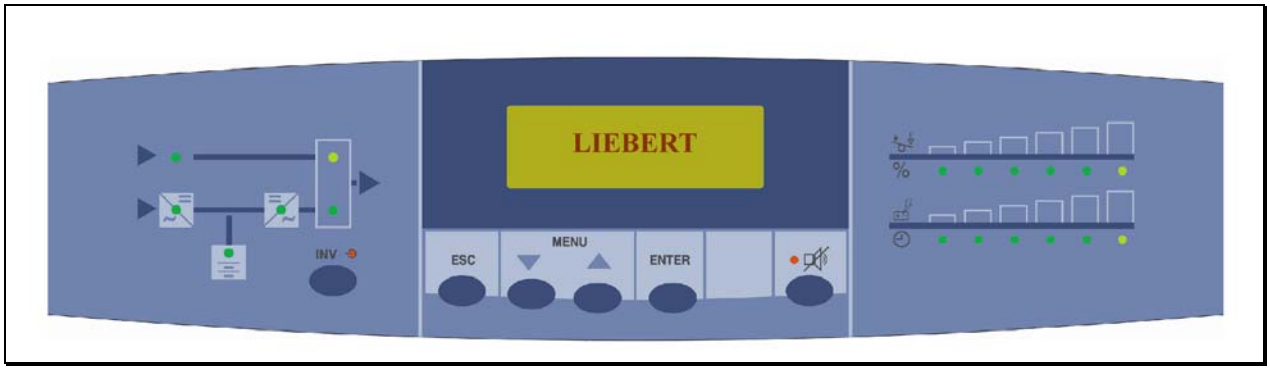


Figure 8-1 UPS Operator control/display panel

8.1.1 Operator control panel

The control and display panel LED indications are illustrated in figure 8-2 and described in the following text:

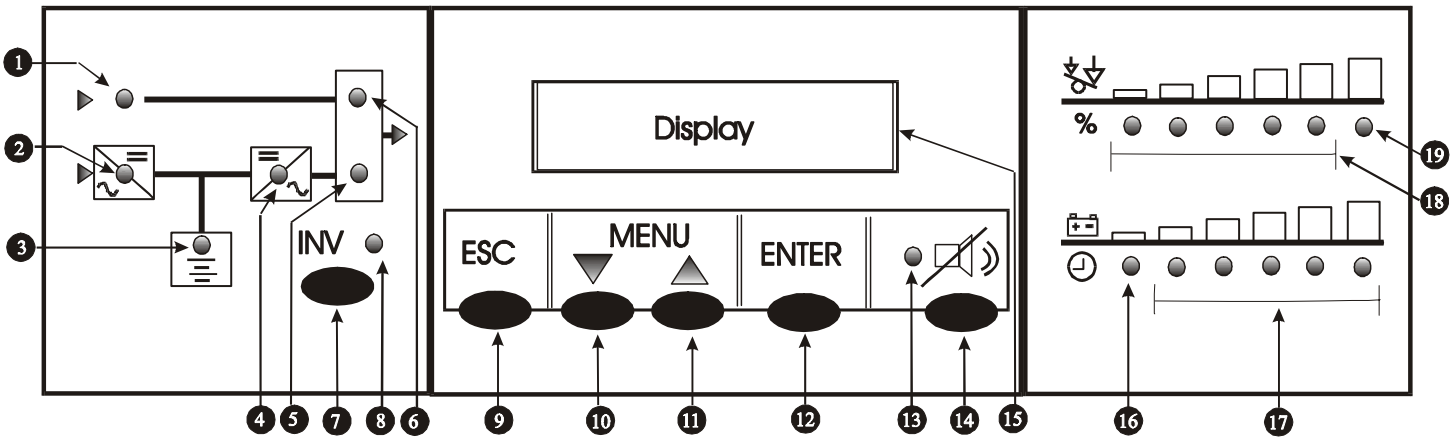


Figure 8-2 Single module operator control panel

Mimic indications

Six LED's mounted on a single line diagram represent the various UPS power paths and show the current UPS operational status:

1 Bypass supply healthy

This led illuminates when the bypass a.c. input power switch is closed and the input supply is within of set value nominal voltage (default ±10%).

2 Input supply healthy and Rectifier is operative.

3 Battery status healthy.

This LED illuminates when the battery is discharging and flashes when the battery circuit breaker is open.

4 Inverter output healthy.

5 Load on Inverter status.

This led illuminates when the output power switch is closed and the load is connected to the inverter

6 Load on Bypass status.

This led illuminates when the output power switch is closed and the load is connected to the bypass a.c. supply via the static switch.

Inverter control switch

7 Inverter ON — Manual inverter selection switch.

8 Inverter LED — inverter status indicator contained above the switch icon.

The Inverter Led (yellow) indicates when the Inverter is switched OFF.

Menu Control switches

Four push button switches ESCape [9], DOWN [10], UP [11], ENTER [12], are located below the LCD display and are used to navigate a menu-driven UPS operating and control system.

Note 1: *In addition to entering the day-to-day operating functions, the menu system is also used to set-up various UPS operating parameters during commissioning. A system of password protection is therefore used to limit the control functions accessible to the operator, whilst allowing full access to maintenance personnel. A full description of the available menus is provided in the appropriate User and Commissioning manuals.*

Note 2: *From the display Panel Menu it possible to select one of the following languages: English ([1]), Italian ([1]), French, Spanish and German. The sequence is Default Window ⇒FUNCTION⇒ENTER PASSWORD⇒PANEL SETUP⇒LANGUAGE.*

Default language is English.

Other languages can be selected as: English ([1]), Italian ([1]), Dutch, Swedish and Norwegian. It requires a replace of the programmable component.

Note: ([1]) Base languages are English and Italian.

9 **ESC** Pressing the ESCAPE cancels the most recent actions;

i.e. when selecting options it returns the previous window to the LCD;

when setting parameters, it exits the window without saving the new settings;

10 **MENU ∇** The DOWN push-button moves a cursor down the LCD over the options offered on certain windows, and changes the highlighted parameter values in others.

11 **MENU Δ** The UP push-button moves a cursor up the LCD over the options offered on certain windows, and moves a rectangular cursor to the next digit on the right when changing parameter values in others;

12 **ENTER** Pressing ENTER, when selecting options, displays the next window;

The next window is determined by the option which has been selected in the present window.

When selecting new parameters its saves the new parameters.

13 Warning Indicator — The red LED within the Alarm Silence Switch illuminates when a WARNING alarm is displayed on the LCD message screen, and is normally accompanied by an audible alarm.

14 Alarm Silence Switch — Pressing the Alarm Silence Switch cancels the audible alarm but leaves the warning message displayed until the inappropriate condition is rectified.

Operator Panel & LCD Display

15 LCD Display

The LCD display is capable of showing four rows of 20 characters; the top row displays the UPS warning and alarm messages and the lower row indicate the selected metered parameters.

During normal operation the top line of the LCD panel shows the general UPS Status (e.g. *NORMAL OPERATION*) and the bottom line will indicate the current time and date – this is known as the 'Default Screen'. Pressing the ESCape button [9] changes the displayed information to indicate the Communications Port status (if connected) and the version of the software fitted to the UPS control boards.

Pressing the ENTER button [12] from the Default Screen gives the operator access to the 'Measurements/Alarm history' menu which facilitates access to the following measurements:

- *Output Parameters*

– Output Voltage (L-L or L-N for all three phases)
– Output Current (all three phase currents displayed in Amperes or as a % Load)
– Output Power (for all three phases displayed in kW or kVA)
– Output Frequency (of inverter and bypass mains)

- *Input Parameters*

– Input Voltage (L-L for all three phases)

- *Battery Parameters*

– Battery Voltage
– Battery Current
– Battery Charge (in %) or remaining autonomy time when the battery is discharging.

- *Temperature*

– Battery Temperature (°C)

❖ *Alarm History:* It provides current and historical events and the alarms, with date stamping.

❖ *Running Time:* It shows the operating hours of the UPS.

Bargraph Section

This following functional area shows the various UPS load and battery charging conditions.

16 Load Battery

The amber LED situated at the beginning of the % Autonomy bargraph illuminates when the battery voltage has discharged to 1.8V/cell and indicates that the battery is approaching its low voltage cut-off point and the UPS will shortly shut-down.

17 % Battery state Autonomy time bargraph

When the battery is being charged (normal) the five leds illuminate progressively to indicate the state of battery charge as a percentage of a charge. When the battery is discharging (battery on-load) the bargraph function changes to provide an indication of the remaining battery autonomy time.
With a fully charged battery all five LEDs are illuminated indicating that time remaining is dependent upon both the battery A/Hr capacity and the applied percentuage load. An autonomy is determined from the type of battery used, as the autonomy falls below this time the LEDs will extinguish in steps starting from the right-hand end.

18 % Load bargraph

The five leds illuminate progressively to indicate the applied load as a percentage of the rated maximum current, increasing in 20% steps to 100% of full load when all five are illuminated.

19 Overload

The amber LED situated at the end of the % Load bargraph illuminates if the applied load exceeds 100% of the module(s) rated output current. This indication will be accompanied by an audible alarm and an alarm message.

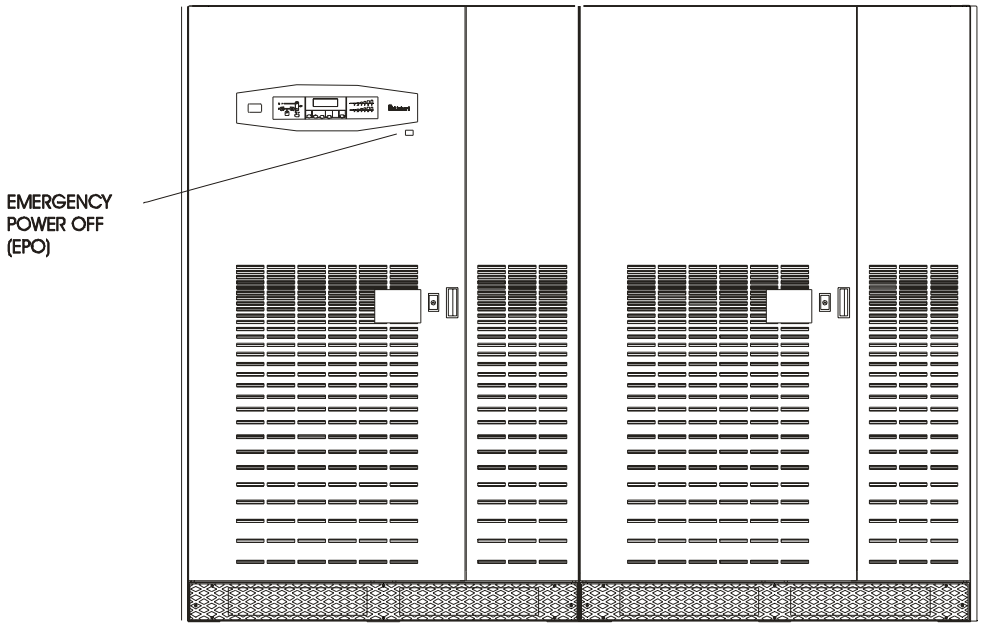


Figure 8-3 EPO on UPS module

20 Emergency Stop — housed beneath a safety cover to prevent inadvertent operation
When the emergency stop switch is pressed it disables the static switch block entirely **(so removing load power)**. It also disables the rectifier and inverter, and trips the battery circuit breaker. Under normal circumstances it does not remove UPS input power since this is applied through a manually controlled external isolator; however, if the UPS input supply is connected via a circuit breaker having an electrical trip facility, emergency power off can be used to drive the external circuit breaker's trip circuit.

8.1.2 The Menu Options

A map of the routes to the options offered by the menu is provided in figure below. Options include windows which show status information and windows which permit data to be entered, or parameters for equipment control to be set. The menu map shows that the routes pass from the main menu through different intermediate windows to reach the option targeted. The diagram shows each of the windows in the format in which it appears on the LCD screen. The initializing, default & main menu windows are described below.

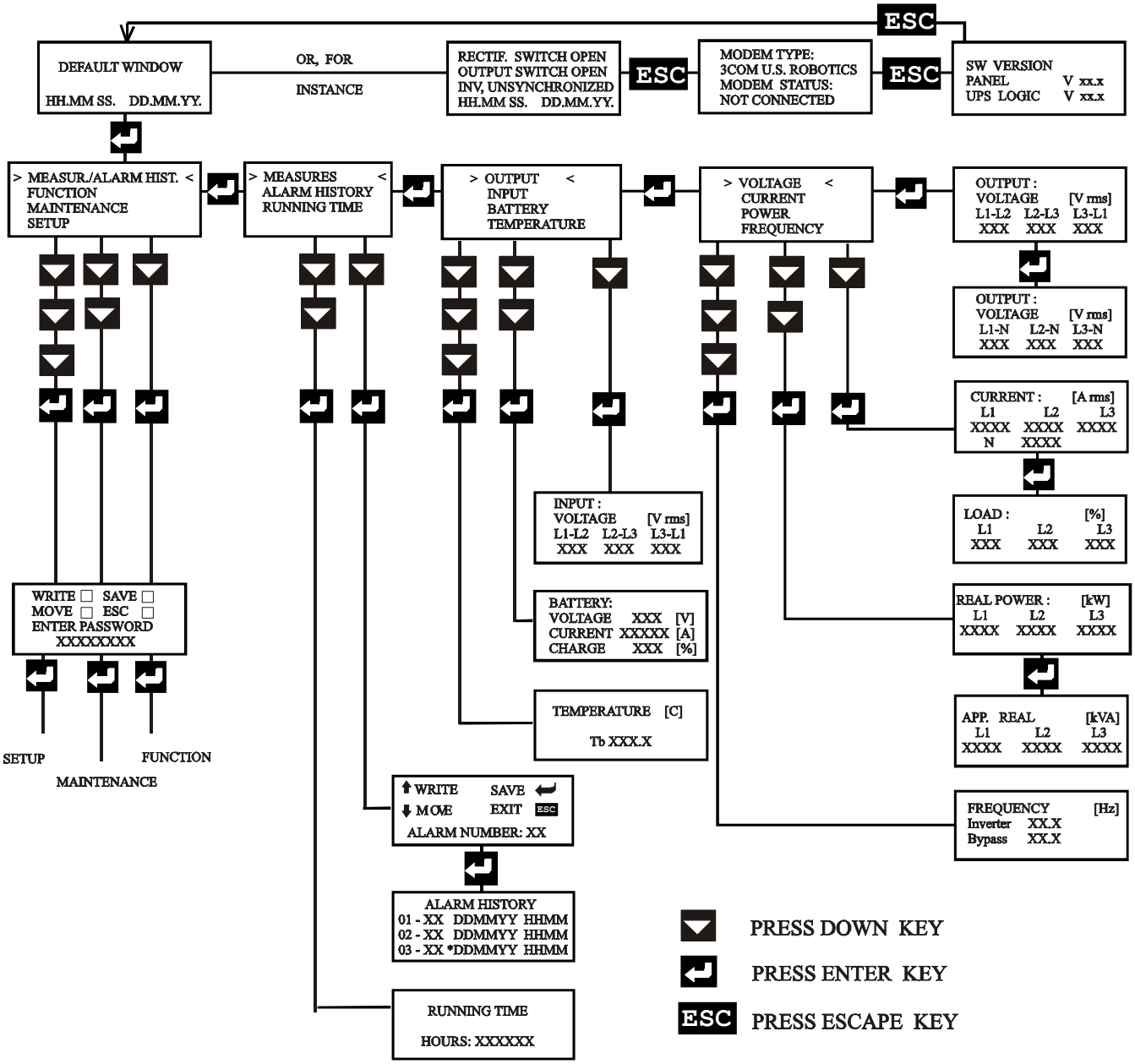
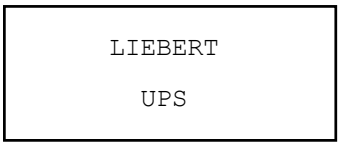
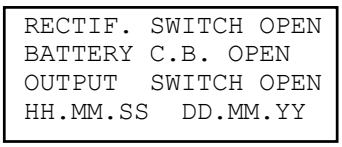
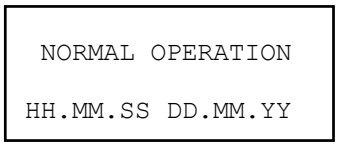


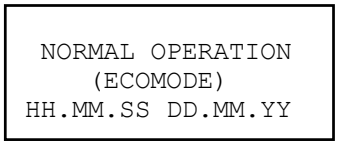
Figure 8-4 Map of screen display available to operator

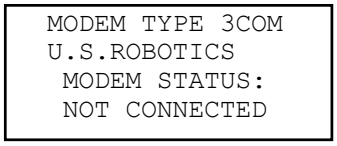
LCD Display Panel Messages

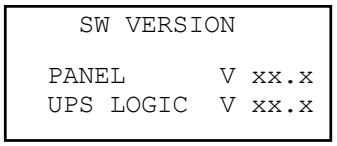


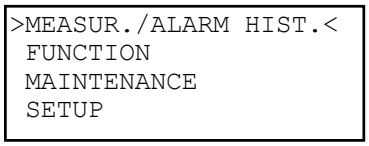












- **Initializing Window.**

After first connecting power to the UPS and closing the bypass a.c. input power switch, the INITIALIZATION message will appear on the LCD screen. It persists for about five seconds while the control firmware is loaded and the unit performs a self test. It is followed by a window showing various messages with the time and date on the bottom line.

When the power switches and battery circuit breaker have been closed and the inverter has stabilized the window will change to the default window.

- **Default Window.**

The message shown below, will be seen on the default window whenever the UPS is operating normally:

The top lines display the UPS operational status and indicates alarm conditions when they occur; and line four normally shows the time and date.
If the ECOMODE configuration is in effect, the default window will be modified as shown to the side.

- **Info Window.**

From Default Window, pressing the ESC key, information about the modem programmed in memory and its connection are shown on display.

Pressing again the ESC key, software release are shown, both on UPS board and on Panel board: this feature is useful upgrading SW for next versions and to know exactly features of present release.

Pressing again ESC key it goes back to Default Window.

- **Main Menu Window.**

The main menu is selected from the Default Window by pressing the ENTER key:

The four windows accessed from the Main Menu offer further options which are described in the relevant chapters of this manual.

The MEASUREMENT option gives access to windows which show the present values of parameters such as input & output voltages and current, load etc. These parameters are useful when determining the state of the UPS or the causes of alarms, and are described in more detail below.

The ALARM HISTORY window displays detailed current and historical event, warnings and alarm can be scrolled on the UPS display or can be simultaneously gathered through background RS232 port or LAN. The ALARM HISTORY procedure is detailed in Chapter 9.

The FUNCTION, MAINTENANCE and SETUP options all require a password which is set by the commissioning engineer. This manual does not provide servicing instructions and the options accessed from these windows are therefore not shown on the menu map in figure 8-4. Only trained service engineers should be authorized with a password.

In any case FUNCTION, MAINTENANCE and SETUP options can be read but it is not possible to change them without the password.

- **Option Selection Mode**

If a window from which options can be selected is displayed, a pair of indicator arrows appear at the extremities of the line.

The UP/DOWN push buttons move these up and down the screen over the options. When the arrows point at a chosen option, press ENTER to display the next window. Press ESCAPE to return the previous window to the screen.

Alarm/Warning messages

The Alarm and Warning messages are shown on the three upper lines of the display. The ALARM indicator (red) and audible warning accompany all Alarm messages.

There is a default selection for every message and corresponding mode of red indicator (OFF, ON, FLASHING) and buzzer sound (OFF, ON, INTERMITTENT, SINGLE SOUND).

The default mode can be changed according to particular needs of the plant, a PC and communication program are needed .

The Alarm and Warning messages are detailed in Chapter 10 - Display Panel Interpretation of this manual.

This page is left blank intentionally

9 Chapter 9 - Operating Instructions

9.1 Introduction

The UPS can be considered to be in one of following operating conditions:

- **Normal operation** - All relevant power switches and circuit breakers closed, the load is powered by the UPS.
- **On Maintenance Bypass** - UPS shut down but the load connected to the unprotected mains via the Maintenance Bypass Supply line.
- **Shutdown** - All power switches and circuit breakers open - no load power.
- **On Static Bypass** - The load power is supplied though the mains static bypass line. This may be considered as an intermediate operating condition being utilized for the purpose of load transfers between inverter and maintenance bypass or supply under abnormal operating conditions.
- **ECOMODE** – All relevant power supply switches and the battery switch are on, and the load is fed by the Bypass Mains through the UPS Static Transfer Switch, while the Inverter remains on stand-by.

This chapter contains instructions which enable you to switch between the above conditions, to carry out a RESET and how to switch ON\OFF the inverter, etc.

9.1.1 General notes

Note 1: All the user controls and indicators (led) mentioned in these procedures are identified in Chapter 8.

Note 2: The audible alarm may annunciate at various points in these procedures. It can be cancelled at any time by pressing the `Alarm Reset' push-button.

Note 3: The Liebert Hipulse E UPS System incorporates an optional automatic boost charge facility which can be used in systems containing conventional flooded lead-acid batteries. If this type of battery is used in your installation you may notice that the battery charger voltage may be greater than its nominal (513Vdc for 380Vac, 540Vdc for 400Vac and 567V for 415Vac system) when the mains supply returns from a prolonged outage. This is the normal response of the boost charge facility: the charger voltage should return to normal after a few hours.

9.1.2 Power Switches

The UPS can be separated by means of power switches, mounted inside the cabinet and accessible after opening the front door, which has a key.
The location of the UPS power switches is shown in Figure 9-1.

The **UPS module** power switches are:
Q1 - Input Isolator: connects the UPS with the mains supply.
Q2 - Bypass Isolator: connects the UPS with the bypass supply.
Q3 – Maintenance Bypass Isolator (padlocked) permits supply of the load directly by the bypass line for maintenance of the UPS module.
*The internal maintenance bypass must not be used when the UPS system is comprised of **more than two UPS** modules in parallel.*
Q4 - Output Isolator: connects the output of the UPS to the load.

Note : The battery interrupter is not internal to the UPS and should be installed in the proximity of the respective battery.

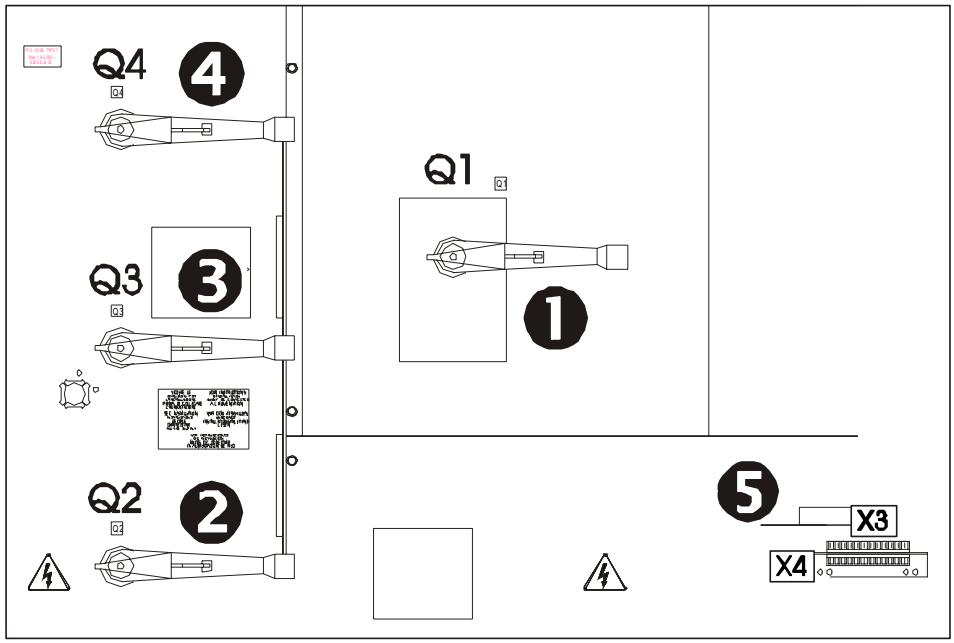


Figure 9-1 Power Isolator Location

❶ Input Isolator (Q1)
❷ Bypass Isolator (Q2)
❸ Maintenance Bypass Isolator (Q3)
❹ Output Isolator (Q4)
❺ Terminal blocks

9.2 Procedure for UPS Start-Up: without interrupting power to the load

This procedure will describe how to start the UPS and the how to transfer the load from the external maintenance bypass to the UPS inverter. It is assumed that the installation is complete, the system has been commissioned by authorized personnel and the external power isolators are closed. Refer to Fig. 9-1 for corresponding isolators Q1 to Q4.

ENSURE CORRECT PHASE ROTATION.

1. Close Q3 Maintenance Bypass switch and external switch (inside Maintenance Bypass) to load.
2. Close the Output power switch Q4 and the Bypass power switch Q2.

```
      LIEBERT

        UPS
```

Initializing Window: after first connecting power to the UPS and closing the isolator, this message will appear on the LCD screen. It persists for about five seconds while the control firmware is loaded. It is followed by a screen showing various messages with the time and date on the bottom line.

The *Module Mimic* indicators *Bypass supply healthy* (1) and after 20 seconds *Load on bypass* (6) will flash and red led (13) will illuminate.

```
RECTIF. SWITCH OPEN
BATTERY C.B. OPEN
MANUAL BYPASS CLOSED
 HH.MM.SS  DD.MM.YY
```

The Display window will show the present status of the UPS:

3. Close the Rectifier input power switch Q1.

```
LOAD ON BYPASS
MANUAL BYPASS CLOSED
INV OFF
 HH.MM.SS  DD.MM.YY
```

Note: In **ECOMODE** the message 'LOAD ON BYPASS' will not appear.

4. Wait for 20 seconds then close the battery circuit breaker.
   The *Module Mimic* indicator (3) *Battery unavailable* should extinguish. Several LED's on the *Battery state of charge bar graph* will illuminate showing the battery state of charge.

   The rectifier will `walk-in' and stabilize at float the voltage.

5. Open the Maintenance Bypass power switch Q3 and fit lock.
   The *Module mimic* indicator *Load on bypass* (6) will Flash amber.

```
 LOAD ON BYPASS
 INV.: OFF

 HH.MM.SS  DD.MM.YY
```

The Display window will show the present status of the UPS:

6. After 5 seconds the *Module Mimic* LED's will change so that the *Load on inverter* (5) will light steady green and the *Load on bypass* (6) will extinguish.

Note: In **ECOMODE** the *Load on Mains* led (6) stays on while the *Load on inverter* led (5) is off.

NORMAL OPERATION HH.MM.SS DD.MM.YY

The message shown below, will be seen on the *default screen* whenever the UPS is operating normally:

The UPS is operating normally with its inverter supplying the load.

NORMAL OPERATION (ECOMODE) HH.MM.SS DD.MM.YY

ECOMODE: The following message will appear in the default screen whenever the UPS is operating in **ECOMODE**. The load is supplied by the Bypass Mains.

The UPS is operating in ECOMODE with the Bypass Mains supplying the load.

9.3 Procedure for UPS Start-Up: without power initially supplied to the load

This procedure should be followed when turning on the UPS from a fully powered down condition - i.e. where the load is not being initially supplied at all. It is assumed that the installation is complete, the system has been commissioned by authorized personnel and the external power isolators are closed. Refer to Fig. 9-1 for corresponding isolators Q1 to Q4.

1. Open the UPS door(s) to gain access to the main power switches.

2. Close the Rectifier Power Switch Q1.
   The *Module Mimic* LED's will indicate *input supply a.c. present* (2 - steady green) and after approximately 20 seconds the *Inverter output healthy* (4 - steady green) and *Battery unavailable (3)* will light and also red led (13) will illuminate.
   The Display screen will show the following:

```
      LIEBERT

        UPS
```

Initializing Window: after first connecting power to the UPS and closing the Q1 isolator, this message will appear on the LCD screen. It persists for about five seconds while the control firmware is loaded. It is followed by a screen showing various messages with the time and date on the bottom line.

```
BYPASS SWITCH OPEN
BATTERY C.B. OPEN
OUTPUT SWITCH OPEN
 HH.MM.SS  DD.MM.YY
```

Note: If input power is present but the display remains blank, then the Micro Controller is not working, please contact your dealer for advice.

WARNING

THE FOLLOWING ACTION WILL APPLY POWER TO THE LOAD EQUIPMENT - ENSURE THAT IT IS SAFE TO DO SO.

3. Close the UPS output power switch Q4.
   The *Module Mimic* LED's will change so that the *Load on inverter* (5 - steady green) and *Battery unavailable (3)* will light and also red led (13) will illuminate.

Note: In **ECOMODE** the *Load on inverter* led (5) is off.

The display window will show:

```
BATTERY C.B. OPEN
BYPASS SWITCH OPEN

 HH.MM.S  DD.MM.YY
```

4. Close the Bypass input power switch Q2.
   Bypass input Led (1 – steady green) will light, after 20 seconds the inverter synchronises with the mains bypass.

```
BATTERY C.B. OPEN


  HH.MM.S  DD.MM.YY
```

5. Before closing the battery circuit breaker check the d.c. bus-bar voltage. From the above window press the ENTER key:

The Main Menu Window will display:

```
> MEASUR./ALARM HIST.<
  FUNCTION
  MAINTENANCE
  SETUP
```

Select MEASUREMENT/ALARM HISTORY and press ENTER key:

```
 >MEASURES<
  ALARM HISTORY
  RUNNING TIME
```

Select MEASURES and press ENTER key.

```
    OUTPUT
    INPUT
  > BATTERY   <
    TEMPERATURE
```

Select BATTERY and the d.c. bus bar voltage will be displayed:

```
   BATTERY:
   VOLTAGE      540 [V]
   CURRENT      001 [A]
   CHARGE       000 [%]
```

If the voltage indicated is satisfactory (513Vdc for 380Vac, 540Vdc for 400Vac and 567V for 415Vac system) press the escape key repeatedly until the display returns to the original window.

6. Manually close the battery circuit breaker.
   The *Module Mimic* indicator (3) *Battery unavailable* should extinguish. Several LED's on the *Battery state of charge bargraph* (17) will illuminate showing the battery state of charge.
   When the battery circuit breaker has been closed and the inverter has stabilized the screen will change to the default window.

Default Window.

The message shown below, will be seen on the default screen whenever the UPS is operating normally:

```
  NORMAL OPERATION

  HH.MM.SS  DD.MM.YY
```

The top lines display the UPS operational status and indicates alarm conditions when they occur; and line four normally shows the time and date.

The UPS is operating normally with its inverter supplying the load.

```
  NORMAL OPERATION
     (ECOMODE)
HH.MM.SS DD.MM.YY
```

ECOMODE: The following message will appear in the default screen whenever the UPS is operating in **ECOMODE**. The load is supplied by the Bypass Mains.

The UPS is operating in ECOMODE with the Bypass Mains supplying the load.

9.4 Procedure for Switching the UPS into a Maintenance Bypass condition from normal operation.

The first part of this procedure details how to select the Inverter OFF and power the load from the bypass mains via the Static Switch. This procedure should be followed to transfer the load from the UPS inverter output to the maintenance bypass system. This may be required during UPS maintenance procedures.
NORMAL OPERATION: follow the procedure below to transfer the load from the inverter output to the Maintenance Bypass of the UPS.

ECOMODE: follow the procedure below to transfer the load from the output to the Maintenance Bypass of the UPS.

Caution

The following window allows the operator to select the UPS inverter ON or OFF.
Before making this operation, read messages on display to be sure that bypass supply is regular and the inverter is synchronous with it, not to risk a short interruption in powering the load.

*IF YOU ARE NOT **SURE** OF WHAT YOU ARE DOING - THEN **DO NOT DO IT**.*

1. Press the INV switch on the left side of the operator control panel.
2. Confirm this operation as instructed at the display:

```
WARNING! STOP
INVERTER REQUESTED
ENTER  TO CONTINUE ↵
ESC   TO CANCEL
```

Press Enter for 1 second to confirm INV OFF
Press Esc for 1 second to exit

3. If Enter is pressed:
   The *Module Mimic* indicator *Load on Inverter* (5)will extinguish and the *Load on Bypass* indicator (6) will flash amber, and also the red led (13) will flash and normally will accompanied by an audible alarm.
   Pressing the Alarm Silence Switch cancels the audible alarm but leaves the warning message displayed until the appropriate condition is rectified.

NORMAL OPERATION:

4.a The UPS inverter will now shut down and the load will transfer to the Bypass supply.
The Module Mimic indicator *Load on Bypass* (6) will flash amber and the *Load on Inverter* (5) indicator will extinguish.

Your load is now powered via the Static Bypass system.

ECOMODE:

4.b At this point the UPS inverter stops but the load continues to be supplied by the bypass mains.
The *Load on Mains* indicator light (6) on the unit's synoptic panel flashes yellow, and the *Load on Inverter* indicator light (5) goes off.

Your load is now powered via the Static Bypass system.

5. Unfasten the lock, release the internal safety bar and close the maintenance bypass power switch Q3. Open the Rectifier input power switch Q1, the Output power switch Q4, the bypass power switch Q2 and the Battery circuit breaker.
   The unit will power down but the load will continue to be supplied by the manual Maintenance bypass.

WARNING

WARNING: Wait 5 minutes for the internal d.c. bus bar capacitors to discharge.

WARNING

The following points will be live within the UPS:

- *Bypass a.c. input supply terminals and busbars*
- *Maintenance Bypass power switch*
- *Static Bypass power Switch*
- *UPS output terminals and busbars*

Input and output terminals remain protected by a metallic cover.

Your load is now powered from the maintenance bypass system and the UPS is completely shut down.

Caution

The load equipment is not protected from normal supply aberrations when operating in the maintenance bypass mode.

9.5 Procedure for Switching the UPS ON from a Maintenance Power condition.

Follow the procedure for **'UPS Start-Up: without interrupting power to the load'** referring to the paragraph 9.2, start from point number 2.

9.6 Procedure for completely powering down a UPS

This procedure should be followed to completely power down the UPS and **LOAD**. All power switches, isolators and circuit breakers will be opened and there will be ***no load power***.

Caution

The following procedure will switch off all power to the load equipment.

1. Open the battery circuit breaker and the Rectifier input power switch Q1.
   The *Module Mimic* indicator *Load on Inverter* (5)will extinguish and the *Load on Bypass* indicator (6) will flash amber. The *battery not available* indicator (3) will light amber and the battery bar graph LED's will all extinguish.

```
LOAD ON BYPASS
BATTERY C.B. OPEN
RECTIF. SWITCH OPEN
HH MM SS  DD MM YY
```

The display window will show messages reflecting the actions taken (i.e. Load on Bypass: Battery Breaker open: Rect. switch open: etc.).

Note: In **ECOMODE** the message 'LOAD ON BYPASS' will not appear.

2. Open the Output power switch Q4 and the bypass power switch Q2.
   All operator LED indications and messages will extinguish as the mains driven internal power supplies decay.

3. To completely isolate the UPS from the a.c. supplies, the main external power input isolator (both isolators, where separate supplies are provided for rectifier and bypass) should be opened.

On the primary input distribution panel, which is often located distant from the UPS area, a label should be posted advising service personnel that the UPS circuit is under maintenance.

WARNING

WARNING: Wait 5 minutes for the internal d.c. bus bar capacitors to discharge.

The UPS is now completely powered down.

IMPORTANT

The Maintenance Bypass Power switch may be operated at any time when the UPS is powered down to connect the load to the maintenance bypass supply if required.
The load equipment is not protected from normal supply aberrations when operating in the maintenance bypass mode.

9.7 RESET procedure following shutdown of automatic switching or emergency stop (EPO action).

Once all appropriate measures have been taken to correct the problem indicated by the alarm message appearing on the operator control panel display, carry out this procedure to restore the UPS to regular operation following an Emergency Stop or a shutdown of automatic switching.
Automatic switching may be shut down for the following reasons: the Emergency Stop button is pressed, Inverter Overtemperature, Cut-off Overload, Battery Over voltage, excessive switching (BYP: XFER COUNT BLOCK), etc.

```
  EMERGENCY STOP
  LOAD ON BYPASS
  INV: UNSYNCHRONIZED
  HH MM SS   DD MM YY
```

Press the ENTER key

Note: In **ECOMODE** the message 'LOAD ON BYPASS' will not appear.

```
  MEASUR./ALARM HIST.
  > FUNCTION     <
    MAINTENANCE
    SETUP
```

Select FUNCTION and press ENTER key

```
  ↑WRITE      SAVE↵
  ↓MOVE      EXIT ESC
  ENTER PASSWORD
     00000000
```

When the PASSWORD has been completed press the ENTER key.

```
    BATTERY TEST
    GENERATOR
    PANEL SETUP
  > NEXT PAGE   <
```

Select NEXT PAGE and press ENTER key

```
  PROTOCOLS
  ON/OFF UPS CONTROL
  RELOAD UPS DATA
 >RESET  BUFFERS <
```

Press the ENTER key

```
  RESET ALARM HISTORY
  RESET EVENT HISTORY
  >RESET ALARMS<
```

Select RESET ALARMS and press ENTER key

Return the Display window to normal by repeatedly pressing the ESCAPE key back through the various windows until the default screen is displayed.

These operations resets the logic circuitry to enable the rectifier, inverter and static switch to operate normally.

Note: When the remote EPO switch has been activated it is necessary to manually close the battery circuit breaker.

WARNING

When the EPO system incorporates a trip facility of the external a.c. input power supply circuit breaker, the RESET switch would have no affect on it. First close the external a.c. input supply circuit breaker, the UPS can be started in the normal manner, as the logic circuits will automatically reset on return of the power supplies.

9.8 Adding a single Module to an existing system

This procedure should be carried out only by trained service personal.

9.9 Procedure to completely switch ON\OFF the UPS at the ups display control panel.

1. From the Default window press the ENTER key: the Main Menu Window will display:

```
MEASUR./ALARM HIST.
> FUNCTION     <
  MAINTENANCE
  SETUP
```

2. Select FUNCTION and press ENTER key:

```
↕WRITE      SAVE↵
↓MOVE      EXIT ESC
  ENTER PASSWORD
     00000000
```

Before being allowed into the FUNCTION windows you are requested to enter a password. This is achieved by pressing the UP arrow key repeatedly until the first digit displays the character required, you then press the DOWN arrow key once to move on to the second digit. This action is repeated for all eight digits. When the PASSWORD has been completed press the ENTER key.

Caution

This operation gives the operator access to modify UPS's operating mode, it is advised that only trained qualified personnel should attempt to do that.

3. You now have access to all function windows.

```
   BATTERY TEST
   GENERATOR
   PANEL SETUP
> NEXT PAGE   <
```

Press the DOWN arrow key until the cursors have selected NEXT PAGE - press the ENTER key.

4. Press the DOWN arrow key until the cursors have selected ON/OFF UPS CONTROL.

```
  MODEM CONNECTION
> ON/OFF UPS CONTROL<
  RELOAD UPS DATA
  RESET  BUFFERS
```

Press the ENTER key.

Caution

The following window allows the operator to select the UPS inverter ON or OFF, select the rectifier ON or OFF, select the rectifier to manual or float voltage and to switch OFF the Line (bypass) voltage to the load
IF YOU ARE NOT ***SURE*** *OF WHAT YOU ARE DOING - THEN* ***DO NOT DO IT****.*

NORMAL OPERATION:

```
  > INVERTER    OFF<
    BYPASS      ON
    RECTIFIER   ON
    RECTIFIER   MAN
```

5.a Ensure INVERTER is selected by the cursors and press the ENTER key:

```
  ↑ROTATE     START↵
            EXIT ESC
   INVERTER      ON
```

The OFF selection will be highlighted, using the UP arrow key, rotate between the selections offered (in this case it will be ON or OFF) select ON. Press the ENTER key to execute your order.

After approximately 20 seconds the *Module Mimic* LED's will change so that the *Load on inverter* (5) will light steady green and the *Load on bypass* (6) will extinguish.

6.a Return the Display window to normal by repeatedly pressing the ESCAPE key back through the various windows until the default screen is displayed.

The UPS is operating normally with its inverter supplying the load.

ECOMODE:

```
    INVERTER    ON
  > BYPASS      OFF<
    RECTIFIER   ON
    RECTIFIER   MAN
```

5.b Ensure BYPASS is selected by the cursors and press the ENTER key:

```
  ↑ROTATE     START↵
            EXIT ESC
   INVERTER      ON
```

The OFF selection will be highlighted, using the UP arrow key, rotate between the selections offered (in this case it will be ON or OFF) select ON. Press the ENTER key to execute your order.

The *Module Mimic* LED's will change: *Load on Mains* (6) will come on and *Load on inverter* (5) will go out.

6.b Return the Display window to normal by repeatedly pressing the ESCAPE key back through the various windows until the default screen is displayed.

The UPS is operating in ECOMODE with the Bypass Mains supplying the load.

9.10 Procedure to switch ON\OFF the inverter at ups display control panel.

Caution

This operation gives the operator access to modify UPS's operating mode, it is advised that only trained qualified personnel should attempt to do that.

```
NORMAL OPERATION

HH.MM.SS  DD.MM.YY
```

The Display window will show the present status of the UPS:

```
NORMAL OPERATION
   (ECOMODE)
HH.MM.SS DD.MM.YY
```

1. Press the INV switch on the left side of the operator control panel.
2. Confirm this operation as instructed at the display:

```
  WARNING! STOP
INVERTER REQUESTED
ENTER TO CONTINUE ↵
  ESC TO CANCEL
```

Press Enter for 1 second to confirm INV OFF
Press Esc for 1 second to exit

3. If Enter is pressed:
   The *Module Mimic* indicator *Load on Inverter* (5)will extinguish and the *Load on Bypass* indicator (6) will flash amber, and also the red led (13) will light and normally will accompanied by an audible alarm.
   Pressing the Alarm Silence Switch cancels the audible alarm but leaves the warning message displayed until the appropriate condition is rectified.

```
INV OFF VIA DISPLAY
LOAD ON BYPASS

HH MM SS  DD MM YY
```

Note: In **ECOMODE** the message 'LOAD ON BYPASS' will not appear.

4. Press the INV switch on the operator control panel to start-up the INVERTER.

NORMAL OPERATION: after 20 seconds the *Module Mimic* LED's will change so that the *Load on inverter* (5) will light steady green and the *Load on bypass* (6) will extinguish.

```
NORMAL OPERATION

HH.MM.SS  DD.MM.YY
```

Return to the normal window.

ECOMODE: the *Load on Mains* led (6) stays on while the *Load on inverter* led (5) will illuminate.

```
NORMAL OPERATION
   (ECOMODE)
HH.MM.SS DD.MM.YY
```

ECOMODE: The following message will appear in the default screen whenever the UPS is operating in **ECOMODE**. The load is supplied by the Bypass Mains.

9.11 Setting the Battery Test

A software-controlled battery test facility can be initiated from the Operator Control Panel on an 'immediate' or 'periodic' basis. This test turns off the rectifier and runs the inverter (and load) from the battery for a predetermined period. If the battery voltage falls below a preset minimum level prior to the termination of the test period a 'BATTERY: TEST FAILED' alarm is annunciated and the rectifier is immediately turned on to prevent the load transferring to bypass — and recharge the battery. This instructions given below initiates an immediate battery test. For the following test to be 'meaningful' as part of the UPS commissioning procedure, the batteries should be fully charged prior to the test being carried out. The UPS rectifier section must therefore be allowed to operate with the battery connected for several hours to provide the battery with an adequate initial charge.

Caution

Do not continue with this procedure if the battery has not yet been charged

1. From the Default window press the ENTER key: the Main Menu Window will display.
2. Select 'FUNCTION' and press ENTER key.
3. When the PASSWORD has been completed press the ENTER key.
4. Select 'BATTERY TEST' and press ENTER key
5. Verify that the parameters entered in the battery test setup menu are appropriate. If not then enter the correct setup parameters (FUNCTION⇒BATTERY TEST⇒SETUP).
6. Press ESC to return to the *Battery test menu* screen.
7. Using the 'UP' menu button, select 'YES" (Y), then press ENTER to initiate an immediate battery test.
8. Step back to default screen, by continually pressing the ESC button and verify that the message: BATTERY UNDER TEST is displayed. The green LED battery bargraph will indicate the remain battery time. *Note:* If the UPS is allowed to run in this condition the battery bargraph LED's will progressively turn off indicating the remaining autonomy time.
9. The battery will be tested for the selected 'DURATION' time after which the UPS will revert to normal operation. *Note:* If the battery fails the test, the rectifier will immediately return to the float mode and the 'BATTERY: TEST FAILED' alarm will be displayed on the default screen.

9.12 Language Selection

If required, select the appropriate language using the following procedure:

From DEFAULT WINDOW press the ENTER key

```
  MEASUR./ALARM HIST.
  > FUNCTION    <
    MAINTENANCE
    SETUP
```

Select FUNCTION and press ENTER key

```
  ↑WRITE      SAVE↵
  ↓MOVE      EXIT ESC
  ENTER PASSWORD
     00000000
```

A PASSWORD must be entered to gain further access to next menu. The initial default password of '00000000' need not to be changed at this point in time. Press the ENTER key.

```
    BATTERY TEST
    GENERATOR
  > PANEL SETUP <
    NEXT PAGE
```

Select PANEL SETUP and press ENTER key

```
> LANGUAGE      ENG<
 TYPE 0000    MASTER
 GROUP 1      UPS 1
 PASSWORD 00000000
```

Select LANGUAGE and press the ENTER key

Use the UP push button to rotate through the available options and select the required default language. There are two language configurations as: English ([1]), Italian ([1]), German, French and Spanish. Default language is English.
Other languages can be selected as: English ([1]), Italian ([1]), Dutch, Swedish and Norwegian. It requires a replace of the programmable component.

Note: ([1]) base languages.

Press ENTER to accept and store the language selection, then step back to the DEFAULT WINDOW by repeatedly pressing ESC as required; the current alarms should now be displayed in the selected language.

N.B. *Ensure the data entered during the procedures described above are recorded in the appropriate commissioning documentation.*

9.13 Changing the current Date and Time

1) From DEFAULT WINDOW, pressing ENTER key, select MAINTENANCE»ENTER»PASSWORD»ENTER»select and enter the line showing the time and date.
2) Position the cursor on the row on which the date-time is displayed, and press ENTER.
3) Using the 'UP' and 'DOWN' menu buttons, enter the current time and date information.
4) Press ENTER to save the settings, then press ESC twice to return to the DEFAULT WINDOW.

9.14 Alarm History

The ALARM HISTORY window displays detailed current and historical events, warnings and alarms. This window allows you to quickly spot trends or diagnose problems that the unit may have had.

```
>MEASUR./ALARM HIST.<
 FUNCTION
 MAINTENANCE
 SETUP
```

The main menu is selected from the Default Window by pressing the ENTER key:
Select MEASUREMENT/ ALARM HISTORY and press ENTER key.

```
 MEASURES
>ALARM HISTORY<
 RUNNING TIME
```

Select ALARM HISTORY and press ENTER key.

```
↑WRITE      SAVE↵
↓MOVE      EXIT ESC
  ALARM NUMBER: XX
```

A request for the numerical alarms will appear.
The last 99 events are stored in a non-volatile memory and can be viewed in the below window. Press the UP arrow key repeatedly until the first digit displays the character required, you then press the DOWN arrow key once to move on to the second digit. Press ENTER to confirm.

```
   ALARM HISTORY

ALARM READING: XX
      BUSY
```

Please wait

```
   ALARM HISTORY
01-05 DDMMYY HHMM
02-20 DDMMYY HHMM
03-30*DDMMYY HHMM
```

This screen shows the history of active UPS alarms, in the order in which they occurred.
Increasing number, alarm code, date and time identify the sequence of the events. The list of the events is continually updated, applying the technique known as FIFO (First In First Out); thus the oldest message is eliminated when the most recent message is added to the list.
The asterisk represents the time in which the event starts. A line with the same alarm code indicates the end of the event.

Press ESC key back through the various windows until the default screen is displayed.

NOTE

Do not reset the buffer memory until the fault signal shown has been examined and remedied by qualified technical service personnel.

9.15 Hours run meter

The HOURS RUN METER window displays the operating hours of the inverter with output isolator and battery c.b. closed. This feature is useful for technical service or for real time MTBF calculation. The Mean Time Between Failure is the time (in average statistics) that passes between two successive failures of a component or system.

1) From DEFAULT WINDOW, pressing ENTER key, select MEASUREMENT/ALARM HISTORY»ENTER»RUNNING TIME»ENTER.

```
   RUNNING TIME

 HOURS: XXXXXX
```

2) Press ESC key back through the various windows until the default screen is displayed.

10 Chapter 10 - Display Panel Interpretation

10.1 LED interpretation

The Led Item number refers to the details shown in figure 8-2 and the Led references that are identified there.

LED NUMBER	NORMAL STATE	INTERPRETATION - ACTION
1	ON	If this green led is OFF it signifies a problem with the bypass input a.c. Check the following: a) Bypass input power switch Q2 is closed. b) Input supply voltage is within 10% of nominal. If the above checks prove unsatisfactory then seek qualified assistance.
2	ON	If this LED is off, a problem exists in the input power supply or in a part of the rectifier. An alarm message is visible at the display. Check that: a) The rectifier input isolator (Q1) is closed. b) The input voltage is within the limits of normal operation. c) The phase sequence of the mains input is correct. d) Verify that condition leading to an emergency stop has not happened, in which case a Reset must be carried out (see Chapter 9 – Operating Instructions). If these checks do not give a positive result, request qualified assistance.
3	OFF	If this yellow led is ON it signifies that the battery is not available. This could be due either to the battery circuit breaker being open or that the d.c. busbar voltage is below the figures stated in (item b) above. The battery circuit breaker will open automatically if the d.c. voltage falls below these levels. Check the following: a) Check that the conditions for Led 2 are satisfied. b) DC busbar voltage — if not above 401V then carry out checks as for Led 2 (mains rectifier failure) above. If the d.c. busbar voltage is greater than 401V but you are unable to close the battery circuit breaker then seek qualified assistance. c) Battery circuit breaker is closed. If the above checks prove unsatisfactory then seek qualified assistance.
4	ON	If this green led is OFF it signifies that the inverter is not producing its correct output voltage. Check the following: a) If [OVERTEMPERATURE] or [OVERLOAD] alarm messages are active then (after allowing the UPS to cool / checking that the load current on the bypass line is not excessive) use the procedure to carry out the reset (see Chapter 9 — Operating Instructions). b) Check that the conditions for Led 2 are satisfied. c) Check that the Inverter led (8 yellow) is OFF, otherwise follow Inverter switch ON procedure. d) Check that no conditions exist which will prevent switching the INV ON (e.g. PC command). e) Verify that condition leading to an emergency stop has not happened, in which case a Reset must be carried out. If the above checks prove unsatisfactory then seek qualified assistance.
5	ON	If this green led is OFF, then it signifies that the load has been transferred to the static bypass supply. If this is an automatic change over it will be accompanied by a fault warning on the display panel: take the appropriate actions for the display indication (see Display alarm message table 10.2).
6	OFF	This led is mutually exclusive to Led 5. If this amber Led is ON, the load has been transferred to the bypass mains supply. Verify the cause by following the alarm indications at the LCD display panel. If the above checks prove unsatisfactory then seek qualified assistance.

LED NUMBER	NORMAL STATE	INTERPRETATION - ACTION
13	OFF	This red LED will flash on and off and indicates that the UPS has detected a fault, it will be accompanied by a message on the display panel, take the required actions for the display panel message (see Display alarm message table 10.2). This will be accompanied by an audible warning. Pressing the Alarm Silence Switch (14) cancels the audible alarm, but leaves the warning message displayed until the appropriate condition is rectified.
16	OFF	If this yellow led is ON it signifies that the battery voltage is low and that the end of battery discharge is near. This will be accompanied by an audible warning
17	N/A	This is a bargraph indicating the battery charge state and would normally have four or five of the LEDs ON. When the unit runs on battery, this bargraph changes to give an indication of the time remaining on battery.
18	N/A	This is a bargraph indicating the % of the total load that is being applied to the system.
19	OFF	If this yellow led is ON it signifies that the applied load has exceeded the maximum. It will be accompanied by all five load bargraph LEDs being ON (item 18), the Alarm warning indication flashing RED (item 13) and an OVERLOAD message on the visual display. This will be accompanied by an audible warning. **Reduce the load immediately**.

10.2 Display panel messages

The messages displayed on the Liebert Hipulse E can be categorized into two types; — (a) ALARM messages these are messages which need urgent attention and warn of a UPS shutdown or imminent shutdown the load would normally transfer to the bypass supply if it is available. All alarm messages are accompanied by an audible warning. — (b) WARNING messages these are messages generated to warn or confirm to the operator of actions taken (i.e. if the rectifier a.c. input supply power switch was opened the Warning message would read RECTIF. SWITCH OPEN).

The following table lists the various messages displayed on the operator panel together with a description of their interpretation.

Alarm code	DISPLAY ALARM MESSAGES	INTERPRETATION
63	EMERGENCY STOP	This alarm indicates that the UPS was shut down by means of the local or remote (if fitted) Emergency Power Off push button (EPO) which is normally due to operator action - investigate why the emergency power off push button was pressed. If the emergency power off push button was not pressed then check the continuity of the circuit to the remote switch. Customer connections; auxiliary terminal block X4; pins 5 and 6; normally closed.
30	INV.: OFF	The INV.: OFF alarm is active whenever the inverter is not producing its correct output voltage; either because it has been switched OFF or due to an internal fault, it will normally be accompanied by one or more of the other inverter fault conditions.
36 37 41 42 43	INV.: OVERVOLTAGE INV.: UNDERVOLTAGE OUTPUT: NO VOLTAGE OUTPUT: WAVEFORM ERR INV: FREQUENCY ERROR	Most of the inverter fault messages are self explanatory however the WAVEFORM ERR. informs the operator that the output voltage peak has flattened caused by an internal inverter problem and therefore the output will be out of limits. The FREQUENCY ERROR message indicates an error in the output frequency of the inverter.
34	INV.: OVERTEMPER.	Over temperature is sensed by a normally-close thermostat fitted to each inverter heat sink. If an over temperature condition arises, the audible alarm will accompany this message: the inverter stops and load transfers to bypass after 3 minutes.
62	OVERTEMP. SHUTDOWN	This message informs the operator that the inverter has been switched off and that the load has been transferred to bypass due to an inverter over temperature.
66	OVERLOAD PRESENT	The inverter overload alarm will annunciate as soon as the load exceeds 100% of the UPS rating,. The load will eventually transfer to the bypass mains supply if the overload condition is present for greater than a predetermined time
61	OVERLOAD SHUTDOWN	This message informs the operator that the load has transferred to bypass due to an inverter overload.
03	OUTPUT SWITCH OPEN	This is a status alarm. The output switch must be selected `CLOSED' at all times except when operating on the maintenance bypass supply
02	BYPASS SWITCH OPEN	This is a status alarm. The bypass input switch must be closed at all times.
05	BATTERY C.B. OPEN	This is a status indication only. Note that if the UPS is operating with the battery circuit breaker open and the mains power fails then the UPS output will also fail together with load power, since the inverter has no battery back-up.
57	BATTERY: FUSE FAIL	This problem should be rectified as soon as possible. If the mains power fails then the UPS output will also fail together with load power, since the inverter has no battery back-up.
51	BATTERY: TEST FAILED	The system has carried out a test of the battery. If this alarm is not accompanied by a [BATTERY C.B. OPEN] or [BATTERY: FUSE FAIL] message then a full check of the battery bank is required
56	DC BUS: UNDERVOLTAGE	When the inverter is operating on the battery this message is displayed when the battery voltage has fallen below a preset value. If the input a.c. power cannot be restored you should shut down your loads.
53	BATTERY: E.O.D.	Battery discharge has continued beyond a preset value. The inverter will have shut down, the system will attempt a transfer to bypass: if there is no bypass supply available, any loads still connected will be without power.

Alarm code	DISPLAY ALARM MESSAGES	INTERPRETATION
20	RECT.: OFF	The RECT.: OFF alarm is active whenever the rectifier (battery charger) is not producing its correct output voltage; this can be caused by, an operator selection to off, an input supply failure, an open rectifier a.c. input power switch or an internal fault which may be accompanied by one of the fault conditions.
04 23 22 25 55 58	RECT.: SWITCH OPEN RECT.: CURRENT LIMIT RECT.: BLOCK RECT.: FUSE FAIL DC BUS: SLOW OVERVOL DC BUS: FAST OVERVOL	Most of the rectifier fault messages are self explanatory however, the DC BUS: FAST OVERVOLTAGE and the DC BUS: SLOW OVERVOL message informs the operator the d.c. bus bar voltage is too high.
10 11 12 13	BYP: ABSENT BYP: OVERVOLTAGE BYP: UNDERVOLTAGE BYP: FREQUENCY ERROR	INPUT FAILURE: input a.c. supply failed or out of specified acceptable range. Do not switch OFF the inverter while this indication is active or the load will lose its power.
15	BYP: SCR FAILURE	One or more of the static switch SCR's has developed a fault. The bypass would not support the load in the event of a UPS failure, immediate action is required. Seek qualified assistance.
14	BYP: PHASE ROT.ERROR	This message informs the operator that the input power lines have been cross-connected and the phases sequence is incorrect.
06	MANUAL BYPASS CLOSED	This is a status warning that the load is being powered through the maintenance bypass line and is unprotected from mains supply aberrations.
35	INV.: UNSYNCHRONIZED	This warns that the inverter is not synchronized with the bypass supply, which is normally due to a problem with the bypass supply being outside an acceptable frequency window. Do not switch OFF the inverter when this alarm is active or the load will experience a 200 msec power break.
52	BATTERY: ON LOAD	This is a status warning that the battery is discharging. It normally accompanies a [BYP: ABSENT] or [RECT: OFF] message.
88	AUTONOMY XXXX min	The micro monitors the battery percentage capacity while on charge and the battery time remaining while on discharge. It calculates the time remaining as function of the discharge current against the programmed ampere hour capacity of the battery. It will update the time remaining as the load is changed
50	BATTERY: UNDER TEST	This message informs the operator that the system is carrying out a periodic battery test.
54	BOOST TIME EXPIRED	This message is only applicable to systems which include the boost charge option, boost time charge elapsed set value, battery should be controlled by service personnel.
18	LOAD ON BYPASS	This is a status warning that the load is being powered through the static bypass line and is unprotected from mains supply aberrations. This action is either selected by the operator or a fault condition, check for other fault messages.
20 21	RECT.: OFF RECT.: OFF VIA DISPLAY	This is a status message confirming that the rectifier has been selected off by the operator from either the front panel display or an external PC or by a switch on UPS µP PCB.
16 17	BYP.: OFF BYP.: OFF VIA DISPLAY	This is a status message confirming that the bypass has been selected off by the operator from either the front panel display or an external PC.

Alarm code	DISPLAY ALARM MESSAGES	INTERPRETATION
30 31	INV.: OFF INV.: OFF VIA DISPLAY	This is a status message confirming that the inverter has been selected off by the operator from either the front panel display or an external PC.
60	BYP:XFER COUNT BLOCK	This message informs the operator that the load has been transferred to the bypass more than eight times in one minute. After eight transfers the load will remain on bypass. This message could be initiated by a load causing the UPS to overload, it requires investigation.
59	BATTERY: GROUND FAULT	This message informs the operator that the battery is not longer isolated from ground and there is a danger of electrocution (included option).
64	BACKFEED FAULT	This message informs the operator that failure of the Bypass static devices has resulted in voltage being fed back to the bypass supply input. If the feature is used then check the circuit up to the remote switch. Customer connections; auxiliary terminal block X4; pins 9 and 10; normally open.
08	FAN FAILURE ALARM	This message tells the operator that there is a failure in the outgoing air ventilation system (included option). When this message appears, the red alarm signal (ref. 13) flashes and an LED comes on the 'Fan Failure Alarm Indicator' inside the UPS. An acoustic alarm will sound. It is essential to solve the problem immediately as it could trigger the over-temperature protection, resulting in transfer of the load to the bypass mains. Repairs must be performed exclusively by specially trained personnel. Please contact an authorised technical assistance service if you have problems.

In addition to the above messages there are a number of software alarms (i.e. BAD EEPROM , INTERNAL BATTERY LOW etc.) that will require attention from a qualified service engineer.

This page is left blank intentionally

11 Chapter 11 - 1+N System

11.1 Installation procedure

11.1.1 Preliminary Checks

Be sure that a parallel kit is present and fitted in each of the modules, and that the modules are of the same rating and with the same SW and HW release (See Section 8.1.2 — The Menu Options).

WARNING

Fitting of the parallel kits and board setting required to convert from Single Module to 1+N must be made by Liebert Service & Support trained personnel.

11.1.2 Protective Devices, power and control cables

Refer to the instructions supplied in the Installation Manual — Electrical Installation.

11.1.3 Emergency Stop (EPO)

The external emergency stop facility is identical to that described for the single module installation — that one individual Emergency Stop button is provided for all modules.

Note that this is a normally closed switch.

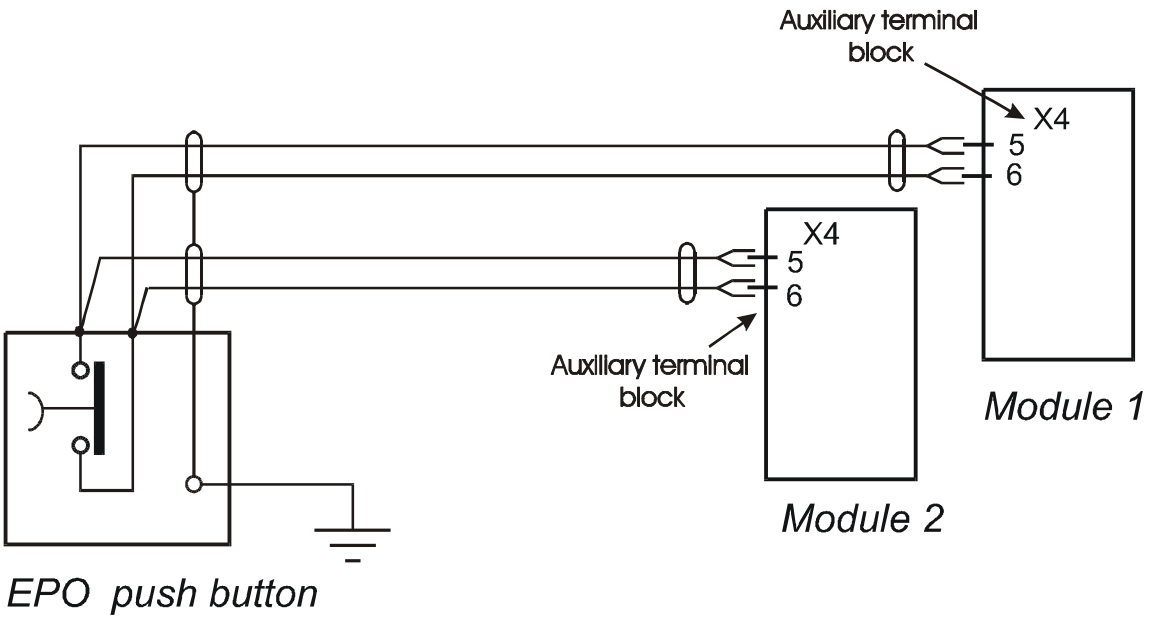


Figure 11-1 Connection of EPO push button.

11.2 Operating Instruction

Starting and stopping the '1+N' system is the same as a single module, however the module' response depends on whether it is configured on the menu of the Operator Control Panel.

11.2.1 System Start-Up and shutdown procedures

WARNING

If differential circuit breakers are used on UPS unit inputs, use a common device only on the system's bypass mains. At the instant of electrical connection, the current may not be split instantaneously and this may cause the residual current circuit-breakers to trip separately.

These operations must be performed one at a time, progressing to the next step only after having completed the previous step on both UPS modules.

11.2.1.1 System start-up

This procedure should be followed when turning on the UPS from a fully powered down condition - i.e. where the load is not being initially supplied at all. It is assumed that the installation is complete, the system has been commissioned by authorized personnel and the external power isolators are closed

1. Open the UPS door(s) to gain access to the main power switches.

WARNING

THE FOLLOWING ACTION WILL APPLY POWER TO THE LOAD EQUIPMENT - ENSURE THAT IT IS SAFE TO DO SO.

2. Close the bypass power switch Q2.
   The *Module Mimic* LED's will indicate *Bypass supply healthy* (1 - steady green) and the *Load on bypass* (6 - flashing amber).
   The Display screen will show the following:

```
      LIEBERT

        UPS
```

Initializing Window: after first connecting power to the UPS and closing the Q2 isolator, this message will appear on the LCD screen. It persists for about five seconds while the control firmware is loaded. It is followed by a screen showing various messages with the time and date on the bottom line.

```
RECTIF. SWITCH OPEN
BATTERY C.B. OPEN
OUTPUT  SWITCH OPEN
 HH.MM.SS  DD.MM.YY
```

Note: If input power is present but the display remains blank, then the Micro Controller is not working, please contact your dealer for advice.

3. Close the Rectifier input power switch Q1 the and UPS output power switch Q4

After approximately 20 seconds the *Module Mimic* LED's will change so that the *Load on inverter* will light (5 - steady green) and the *Load on bypass* (6) will extinguish.
The display window will show:

```
  BATTERY C.B. OPEN


   HH.MM.S  DD.MM.YY
```

4. Before closing the battery circuit breaker check the d.c. bus-bar voltage. From the above window press the ENTER key:

The Main Menu Window will display:

```
>MEASUR./ALARM HIST.<
 FUNCTION
 MAINTENANCE
 SETUP
```

Select MEASUREMENT and press ENTER key:

```
>MEASURES<
 ALARM HISTORY
 RUNNING TIME
```

Select MEASURES and press ENTER key.

```
   OUTPUT
   INPUT
 > BATTERY      <
   TEMPERATURE
```

Select BATTERY and the d.c. bus bar voltage will be displayed:

```
   BATTERY:
   VOLTAGE      540 [V]
   CURRENT      001 [A]
   CHARGE       000 [%]
```

If the voltage indicated is satisfactory (513V d.c. for 380V a.c. system 540V d.c. for 400V a.c. system and 567V d.c for a 415V a.c. system) press the escape key repeatedly until the display returns to the original window.

5. Manually close the battery circuit breaker.
   The *Module Mimic* indicator (3) *Battery unavailable* should extinguish. Several LED's on the *Battery state of charge bar graph* (17) will illuminate showing the battery state of charge.
   When the battery circuit breaker has been closed and the inverter has stabilized the screen will change to the default window.

Default Window.
The message shown below, will be seen on the default screen whenever the UPS is operating normally:

```
   NORMAL OPERATION

  HH.MM.SS  DD.MM.YY
```

The top lines display the UPS operational status and indicates alarm conditions when they occur; and line four normally shows the time and date.

The UPS is operating normally with its inverter supplying the load.

Follow the foregoing procedure for the others UPS.

For a system configured in the "1+N system", the 'N' UPS modules will simultaneously change from "load on bypass" to "load on inverter" provided that a sufficient number of modules are running, and on-line, to satisfy the power load requirements.

11.2.1.2 Switching OFF and isolating one UPS while the other remains in service.

1. In sequence, open the UPS isolators Q4 (output), Q1 (rectifier input), Q2 (bypass input).

2. Open the battery circuit breaker.

To completely isolate the UPS, open the a.c. power supply circuit-breaker (both circuit-breakers if separate supplies are provided for the rectifier and the bypass supply) and the output circuit-breaker on the power distribution switchboard.

WARNING

If individual UPS output isolation circuit-breaker are not installed on the power distribution switchboard, remember that voltage supplied by the others UPS which remains in service will still be present on the output terminals of the shutdown UPS.
WARNING: Wait 5 minutes for the internal d.c. bus bar capacitors to discharge.

11.2.1.3 Switching ON a UPS that was previously switched OFF and isolated from the system.

1. Close the circuit-breakers relative to the shutdown UPS that were previously opened on the power distribution switchboard.

2. Close the switches Q1 (rectifier input) and Q2 (bypass input) of the UPS.

3. Select the MEASUREMENT function from the display on the main menu, then press ENTER and select BATTERY. Press ENTER and check that the voltage level has reached the rated value (513V or 540V or 567V in accordance with the number of battery blocks).

4. Close the battery circuit breaker.

5. Close UPS switch Q4 (output), wait about 20 seconds and check that the message NORMAL OPERATION appears on the display operator panel.

11.2.1.4 Complete system shutdown.

Follow the procedure described in Chapter 9 — Operating Instruction: paragraph 9.6 by working on several UPS modules.

11.2.1.5 Complete system reset.

Follow the procedure described in Chapter 9 — Operating Instruction: paragraph 9.7 by working on several UPS modules.

11.2.2 Procedure for Switching the UPS system into a Maintenance Bypass condition from normal operation *- 1+ 1 Configuration (two UPS's with parallel redundant connection)*

1+ 1 Configuration (two UPS's with parallel redundant connection)

The first part of this procedure explains in detail how to disable the inverters and how to transfer the load to the external maintenance Bypass by means of the UPS static switches. This procedure must be followed to transfer the load from the UPS outputs to the maintenance bypass system, as required during UPS maintenance procedures.
The procedure can only be performed after the installation has been completed (which includes also the maintenance bypass cabinet), after the system has been placed in operation by authorized personnel and after the external power switches have been closed. See the reference drawing of Figure 4-4 for more information.
Note: the procedure can be performed only if option Castell Interlock has been correctly installed. If the system is not equipped with this option, skip the points that describe the operations related to Castell keys (i.e. points 6-7-9-13).

Caution

The following window allows the operator to select the UPS inverter ON or OFF.
Before making this operation, read messages on display to be sure that bypass supply is regular and the inverter is synchronous with it, not to risk a short interruption in powering the load.

*IF YOU ARE NOT **SURE** OF WHAT YOU ARE DOING - THEN **DO NOT DO IT**.*

1. Press the INV switch on the left side of the operator control panel.
2. Confirm this operation as instructed at the display:

```
WARNING! STOP
INVERTER REQUESTED
ENTER  TO CONTINUE ↵
ESC   TO CANCEL
```

Press Enter for 1 second to confirm INV OFF
Press Esc for 1 second to exit

3. If Enter is pressed:
   The *Module Mimic* indicator *Load on Inverter* (5)will extinguish and the *Load on Bypass* indicator (6) will flash amber, and also the red led (13) will flash and normally will accompanied by an audible alarm.
   Pressing the Alarm Silence Switch cancels the audible alarm but leaves the warning message displayed until the appropriate condition is rectified.
4. The UPS inverter will now shut down and the load will transfer to the Bypass supply.
   The Module Mimic indicator *Load on Bypass* (6) will flash amber and the *Load on Inverter* (5) indicator will extinguish.

Your load is now powered via the Static Bypass system.

5. Close the Maintenance Bypass isolator Q3 within the UPS.

```
LOAD ON BYPASS
MANUAL BYPASS CLOSED
INV OFF
 HH.MM.SS  DD.MM.YY
```

The Display window will show the present status of the UPS:

6. Rotate and remove the Castell key from the UPS module.
7. Place and rotate the key in the Castell key exchange box located on or near the external Maintenance Bypass isolator Panel.
8. Repeat steps 1÷7 for the other UPS modules.
9. When all the module keys (BP1) have been placed in the Castell Key Exchange Box, it will be possible to release the trapped key (BP2) from the Box. Remove the key (BP2), place it in the external Maintenance Bypass Isolator (Q3BYP) interlock, and rotate the key. It is now possible to close the external Maintenance Bypass Switch.

10. Close the external Maintenance Bypass Isolator (Q3BYP). The Maintenance Bypass supply is now in parallel with the UPS Static Switch supply.
11. Open the external UPS Isolator (Q4MBC). Rotate and remove the key (BP2) in the external UPS Isolator (Q4MBC). Open the external UPS Switch.
12. Open the Rectifier input power isolator Q1, the Output power isolator Q4, the bypass power isolator Q2 and the Battery circuit breaker.
13. Place and turn the key in the Castell key exchange box situated next to the switch panel of the external Maintenance Bypass Isolator (Q3BYP). Remove the key (BP1), place it in the Maintenance Bypass Isolator (Q3UPS) interlock, and rotate the key.
14. Open the Maintenance Bypass isolator Q3 within the UPS.
15. Repeat steps 12÷14 for the other UPS modules.

The unit will power down but the load will continue to be supplied by the external Maintenance bypass.

WARNING

WARNING: Wait 5 minutes for the internal d.c. bus bar capacitors to discharge.

WARNING

The following points will be live within the UPS:

- *Terminals and busbars of the a.c. Bypass and input rectifier supply*
- *Bypass power isolator*
- *Input rectifier power isolator*

Input and output terminals remain protected by a metallic cover.

WARNING

To completely isolate the UPS from the a.c. supplies, the main external power input isolator (both isolators, where separate supplies are provided for rectifier and bypass) should be opened.

On the primary input distribution panel, which is often located distant from the UPS area, a label should be posted advising service personnel that the UPS circuit is under maintenance.

Your load is now powered from the external maintenance bypass system and the UPS is completely shut down.

Caution

The load equipment is not protected from normal supply aberrations when operating in the maintenance bypass mode.

If it is necessary to perform maintenance or repairs on the UPS system, continue the procedure below.

1. Rotate and remove the key from the external UPS Isolator (Q4MBC)
2. Take the BP2 key from the UPS output isolator to the KX box (Key Exchange Box). Insert the BP2 key and rotate it. The BP1 keys may now be released for return to the UPS modules. Refer to the wiring diagram and check that all the power isolators within the external maintenance bypass cabinet, connected to the output of the UPS's, are open.

11.2.3 Procedure for Switching the UPS system into normal operation from a Maintenance Bypass condition - *1+ 1 Configuration (two UPS's with parallel redundant connection)*

It is assumed that the installation is complete (which includes also the maintenance bypass cabinet), the system has been commissioned by authorized personnel and the external power isolators are closed. Study the reference drawing provided in figure 4-4.
The process of transferring the load back to the UPS supply is the reverse of that described above.

1. Carefully read the messages displayed for the first UPS to make sure that the bypass supply is regular and synchronised with the inverter in order to avoid short interruptions in the load supply.
2. Insert key (BP1) into the UPS and press INVERTER OFF button on the operator control panel (see Figure 8-2).
3. Place and rotate the key in the Castell key exchange box situated next to the switch panel of the external maintenance bypass cabinet.
4. Repeat Steps 1 and 3 for all UPS.
5. Extract key BP2, insert it into the lock next to the UPS output isolator (Q4MBC) and turn it. Close the UPS output isolator (Q4MBC). The external bypass line is now parallel with the bypass supply of the UPS's.
6. Open the external bypass isolator (Q3BYP). Extract key BP2.
7. Place and rotate the key (BP2) in the Castell key exchange box.
8. Remove the BP1 keys from the Castell key exchange box , and turn on the UPS inverters one at a time. The system gradually reaches the ordinary operating status switching the load from the static bypass to the inverters.

11.2.4 Procedure for Switching the UPS system into a Maintenance Bypass condition from normal operation *- 1 + N Configuration (> two UPS's) or two UPS's with parallel power connection*

IMPORTANT

1 + N Configuration (> 2 UPS's) or two UPS's with parallel power connection

It is advisable to take all the necessary measures to prevent the manual Bypass switch inside the UPS (Q3) from being used. This can be done, for example, by removing the handle of the switch and placing on it a warning label for maintenance personnel.

The first part of this procedure explains in detail how to disable the inverters and how to transfer the load to the external maintenance Bypass by means of the UPS static switches. This procedure must be followed to transfer the load from the UPS outputs to the maintenance bypass system, as required during UPS maintenance procedures.
The procedure can only be performed after the installation has been completed (which includes also the maintenance bypass cabinet), after the system has been placed in operation by authorized personnel and after the external power switches have been closed. See the reference drawing of Figure 4-5 for more information.
Note: the procedure can be performed only if option Castell Interlock has been correctly installed. If the system is not equipped with this option, skip the points that describe the operations related to Castell keys (i.e. points 4-5-8).

Caution

The following window allows the operator to select the UPS inverter ON or OFF.
Before making this operation, read messages on display to be sure that bypass supply is regular and the inverter is synchronous with it, not to risk a short interruption in powering the load.

*IF YOU ARE NOT **SURE** OF WHAT YOU ARE DOING - THEN **DO NOT DO IT**.*

1. Press the INV switch on the left side of the operator control panel.
2. Confirm this operation as instructed at the display:

```
WARNING! STOP
INVERTER REQUESTED
ENTER  TO CONTINUE ↵
ESC   TO CANCEL
```

Press Enter for 1 second to confirm INV OFF
Press Esc for 1 second to exit

3. If Enter is pressed:
   The *Module Mimic* indicator *Load on Inverter* (5)will extinguish and the *Load on Bypass* indicator (6) will flash amber, and also the red led (13) will flash and normally will accompanied by an audible alarm.
   Pressing the Alarm Silence Switch cancels the audible alarm but leaves the warning message displayed until the appropriate condition is rectified.
4. Rotate and remove the Castell key from the UPS module. The key, which is fixed in position by means of a mechanical device, can only be removed by pressing the energising button of the solenoid and when the green indicator is on.
5. Place and rotate the key in the Key Exchange Box located on or near the external Maintenance Bypass isolator Panel.
6. Repeat steps 1÷5 for the other UPS modules.

Depending on the UPS system setup, when the number of modules available is less than the number needed in the setup, all the remaining UPS modules will transfer the load to their Static Bypass.

7. The UPS inverter will now shut down and the load will transfer to the Bypass supply.
   The Module Mimic indicator *Load on Bypass* (6) will flash amber and the *Load on Inverter* (5) indicator will extinguish.

Your load is now powered via the Static Bypass system.

8. When all the module keys (BP1) have been placed in the Key Exchange Box, it will be possible to release the trapped key (BP2) from the Box. Remove the key (BP2), place it in the external Maintenance Bypass Isolator (Q5BYP) interlock, and rotate the key. It is now possible to close the external Maintenance Bypass Switch.
9. Close the external Maintenance Bypass Isolator (Q5BYP). The Maintenance Bypass supply is now in parallel with the UPS Static Switch supply.
10. Open the external UPS Isolator (Q4MBC). Open the external UPS Switch.
11. Open the Rectifier input power isolator Q1, the Output power isolator Q4, the bypass power isolator Q2 and the Battery circuit breaker.

The unit will power down but the load will continue to be supplied by the external Maintenance bypass.

WARNING

WARNING: Wait 5 minutes for the internal d.c. bus bar capacitors to discharge.

WARNING

The following points will be live within the UPS:

- *Terminals and busbars of the a.c. Bypass and input rectifier supply*
- *Bypass power isolator*
- *Input rectifier power isolator*

Input and output terminals remain protected by a metallic cover.

WARNING

To completely isolate the UPS from the a.c. supplies, the main external power input isolator (both isolators, where separate supplies are provided for rectifier and bypass) should be opened.

On the primary input distribution panel, which is often located distant from the UPS area, a label should be posted advising service personnel that the UPS circuit is under maintenance.

Your load is now powered from the external maintenance bypass system and the UPS is completely shut down.

Caution

The load equipment is not protected from normal supply aberrations when operating in the maintenance bypass mode.

If it is necessary to perform maintenance or repairs on the UPS system, continue the procedure below.

1. Rotate and remove the key from the external UPS Isolator (Q4MBC)
2. Take the BP2 key from the UPS output isolator to the KX box (Key Exchange Box). Insert the BP2 key and rotate it. The BP1 keys may now be released for return to the UPS modules. Refer to the wiring diagram and check that all the power isolators within the external maintenance bypass cabinet, connected to the output of the UPS's, are open.

11.2.5 Procedure for Switching the UPS system into normal operation from a Maintenance Bypass condition *- 1 + N Configuration (> two UPS's) or two UPS's with parallel power connection*

It is assumed that the installation is complete (which includes also the maintenance bypass cabinet), the system has been commissioned by authorized personnel and the external power isolators are closed. Study the reference drawing provided in figure 4-5.
The process of transferring the load back to the UPS supply is the reverse of that described above.

1. Carefully read the messages displayed for the first UPS to make sure that the bypass supply is regular and synchronised with the inverter in order to avoid short interruptions in the load supply.
2. Insert key (BP1) into the UPS and press INVERTER OFF button on the operator control panel (see Figure 8-2).
3. Place and rotate the key in the Castell key exchange box situated next to the switch panel of the external maintenance bypass cabinet.
4. Repeat Steps 1 and 3 for all UPS.
5. Extract key BP2, insert it into the lock next to the UPS output isolator (Q4MBC) and turn it. Close the UPS output isolator (Q4MBC). The external bypass line is now parallel with the bypass supply of the UPS's.
6. Open the external bypass isolator (Q5BYP). Extract key BP2.
7. Place and rotate the key (BP2) in the Castell key exchange box.
8. Remove the BP1 keys from the Castell key exchange box , and turn on the UPS inverters one at a time. The system gradually reaches the ordinary operating status switching the load from the static bypass to the inverters.

11.2.6 SWITCHING THE SYSTEM ON FROM A MAINTENANCE POWER DOWN CONDITION.

This procedure will describe how to start the UPS and the how to transfer the load from the external maintenance bypass to the UPS inverter. It is assumed that the installation is complete, the system has been commissioned by authorized personnel and the external power isolators are closed. Study the reference drawings provided in figures 4-4 and 4-5. Refer to Fig. 9-1 for corresponding isolators Q1 to Q4.
Note: the procedure can be performed only if option Castell Interlock has been correctly installed. If the system is not equipped with this option, skip the points that describe the operations related to Castell keys (i.e. points 1-8-11-17-18).

ENSURE CORRECT PHASE ROTATION.

1. The Castell keys (BP1) will be located in the UPS. The other keys will located in the Key Exchange Box, and in the external Maintenance Bypass switch.
2. Close external Maintenance Bypass switch (QBYP) (inside Maintenance Bypass cabinet).
3. Close the Output power switch Q4 and the Bypass power switch Q2.

```
LIEBERT

UPS
```

Initializing Window: after first connecting power to the UPS and closing the isolator, this message will appear on the LCD screen. It persists for about five seconds while the control firmware is loaded. It is followed by a screen showing various messages with the time and date on the bottom line.

The *Module Mimic* indicators *Bypass supply healthy* (1) and after 20 seconds *Load on bypass* (6) will flash and red led (13) will illuminate.

```
RECTIF. SWITCH OPEN
BATTERY C.B. OPEN
MANUAL BYPASS CLOSED
 HH.MM.SS  DD.MM.YY
```

The Display window will show the present status of the UPS:

4. Close the Rectifier input power switch Q1.

```
LOAD ON BYPASS
MANUAL BYPASS CLOSED
INV OFF
 HH.MM.SS  DD.MM.YY
```

5. Wait for 20 seconds then close the battery circuit breaker.
   The *Module Mimic* indicator (3) *Battery unavailable* should extinguish. Several LED's on the *Battery state of charge bar graph* will illuminate showing the battery state of charge.

   The rectifier will `walk-in' and stabilize at float the voltage.

6. Repeat steps 1÷5 for the other UPS modules.

7. For UPS 1, using the display panel, turn the "Inverter Off". The UPS display should indicate "Load on Bypass", and "Inverter Off via Display".

8. Rotate and remove the Castell key from the UPS module.

9. Insert and rotate it in the Key Exchange Box. The key, which is fixed in position by means of a mechanical device, can only be removed by pressing the energising button of the solenoid and when the green indicator is on. (only for electric Castell Interlock).

10. Repeat steps 7 and 9 for all the other UPS modules.

11. With all the UPS keys (BP1) located in the Key Exchange Box, remove the trapped key (BP2), insert and rotate it in the external UPS Switch.

12. Close the external UPS Switch (Q4MBC). The Maintenance Bypass supply is now in parallel with the UPS Static Switch supply. All the UPS should be displaying the messages "Load on Bypass" and "Inverter Off via Display".

    All the UPS mimic diagrams should have the amber "Load on Bypass" and green "Bypass OK" LEDs active (#1 and #6, refer to Figure 8-2).
13. Open the external Maintenance Bypass Switch (QBYP).

The load is now being supplied through the UPS static bypasses.

14. Take the key (BP2) to the KX box (Key Exchange Box), insert and rotate.
15. Remove the BP1 keys from the KX box, and turn on the UPS inverters one at a time. Some time during this process, the load will transfer from static bypass to UPS.

The *Module Mimic* LED's will change so that the *Module Mimic* LED's will change so that the *Load on inverter* (5) will light steady green and the *Load on bypass* (6) will extinguish.

Depending on the UPS system setup, when the number of modules available reaches the number needed in the setup, the inverters will automatically restart.

```
NORMAL OPERATION

HH.MM.SS  DD.MM.YY
```

The message shown below, will be seen on the *default screen* whenever the UPS is operating normally:

The UPS is operating normally with its inverter supplying the load.

11.3 Display panel message interpretation '1+N' System

The alarms are the same as for the single module, as given in the previous paragraph, with the additional alarms:

CODE	DISPLAY ALARM MESSAGES	INTERPRETATION
44	INV: PARALLEL ERROR	The parallel board has detected a wrong sharing of the load and has blocked its inverter. Seek qualified assistance.
46	NR. INVERTERS NOT OK	The number of active inverters is below the preset capacity value.

This page is left blank intentionally

12 Chapter 12 - Additional Equipment

The configuration of a system incorporating the Liebert Hipulse E depends on the specific needs of the installation under consideration.
An installation consists of a number of items of equipment, devices and optional boards.
The options may be prepared for installation either in the factory or directly by the customer.
Brief notes on installation of available options are provided below.
Installers must be thoroughly familiar with the product. More detailed information on installation procedures is provided in the Technical Assistance commissioning manual.

The following options are available for the Liebert Hipulse E:

- Fan Failure Alarm Indicator (see par. 2.3.5)
- Battery ground fault detection (see par. 2.3.6)
- Castell Interlock system (see par. 4.4.2)
- Load Bus Synch (LBS) (see par. 12.1)
- Interface Alarm Boards (see par. 12.2)
- Input harmonic filter (see par. 12.5)
- Additional autotransformer (see par. 12.6)
- Isolation transformer (see par. 12.7)
- Degree of protection for the UPS enclosure (see par. 12.8)

RS232 communications:

- RS232 Communications kit
- Modem
- NIC (Network Interface Card)

RS485 communications:

- Modbus/Jbus
- Remote control panel

WARNING

All options must be installed by Liebert global services or Liebert factory-authorized service provided by a Liebert distributor. The option area and customer control cable area contain hazardous voltage if the input source is on, even when the unit is in bypass. Turn all power sources off before installing customer control cables to any option.

12.1 LBS Control System

The simplest way to create a dual-bus system is with Liebert's exclusive Load Bus Sync (HiSynch) option, which keeps two or more UPS systems in sync, even when operating on batteries or asynchronous gensets. Each UPS powers its own downstream distribution equipment, so that each piece of load equipment can be connected to both.
With the correct transfer devices, any connected load can be switched transparently between sources, so that one complete UPS and distribution system can be powered down for maintenance.

12.1.1 OPERATOR CONTROLS

Operation of the LBS has deliberately been kept as simple as possible. There are only three controls and five indicator lights on the LBS enclosure. The indicators are:

A. **LBS Enabled**. Indicates that the load bus sync circuitry is in the Automatic mode.
B. **System Non-Sync**. Indicates that the DSS is no longer in sync with the DMS. This alarm will indicate during the transition from internal bypass sync to DMS sync.
C. **LBS Active**. Indicates that the LBS circuitry has taken over the sync of the UPS. If the System Non-Sync indicator is also on, it means that syncronization is in process.
D. **Load 1 Sync to Load 2**. Indicates that the UPS critical bus is synchronized to the bypass input of the DMS, in this case UPS #2. This indicator will turn on when the sync process is complete.
E. **Load 2 Sync to Load 1**. Indicates that the UPS critical bus is synchronized to the bypass input of the DMS, in this case UPS #1. This indicator will turn on when the sync process is complete.
F. All indicators mentioned above are supplied with **volt free contacts** for remote monitoring.

Standard LBS controls are:
A. **Mode Select Switch**. Provides manual selection of automatic operation or "Off" modes. In the Automatic mode, the LBS will be enabled. In the Off mode, both UPSs will synchronize independently.
B. **Master Select Switch**. Provides manual selection of the DMS source. The LBS circuitry will automatically switch DMS sources should the initially selected DMS lose its bypass input.
C. **Lamp Test**. Push this button to test indicator lights.

12.1.2 OPERATOR PROCEDURES

The only two operator controls are the Mode Select Switch and the Master Select Switch. The Mode Select Switch can be left in the Automatic position all the time. The Off position can be selected at times when it is desired to let the UPSs synchronize independently.
The Master Select Switch allows the operator to choose which UPS bypass source will provide the reference sync signal.
In normal operation, both UPS systems will be functioning and the LBS Mode Select Switch will be in the Automatic position. The LBS Enable indicator will be lighted, as will one of the indicators for Load X Sync to Load Y. If the two UPS drift out of sync (while on generator or battery, for example), the LBS Active and System Non Sync indicators will be lighted. The Load X Sync to Load Y indicator will be off during the synchronization process and turn back on when the process is complete.

12.2 Interface Alarm Boards

12.2.1 Introduction

Two circuit boards, each offering different features and facilities, are available to provide alarm signalling to external devices:

- I\O AS400 Alarm Interface Board (4590055P).
- Extension Alarm Interface Board (4590056Q).

All alarms are generated via software routines on the UPS Logic Board and output from the micro data bus via a series of controlled output buffers. The signals then pass via a piggy-back connection through the Alarm Interface Board (4590055P) to the Remote Alarm Interface Board (4500056Q) where they energise appropriate relay coils via switching transistors.
The AS400 Alarm Board (4590055P) is mounted on the internal metal panel shown in Chapter 6 and connected to ribbon cable (W10 on all models). The Extension Alarm Board (P\N 4500056Q) is also fitted.

Note

As compared to previous models, the two alarm interface boards feature new alarms and additional functions (Field defined alarms). Verify that the UPS is using software version 15 or above (by selecting Info window on the display of the operator's panel).

12.2.2 Board Installation – 4590055P

1. Before installing the AS400 Alarm Interface Board in the UPS, it is necessary to power down that unit. To maintain continuity of supply, the load should first be transferred to the maintenance bypass circuit following the procedure given in Chapter 9.
2. Mount the AS400 Alarm Interface Board on the plastic stand-offs that are already mounted on the internal metal panel inside the UPS at the location identified in the figures of Chapter 6.
3. Turn the plastic screwhead of the plastic standoffs in a clockwise direction.
4. Connect the ribbon cable (W10) to connector X1 on the AS400 Alarm Interface Board (4590055P).
5. Connect the external signal cables, as required, to the terminal block connectors identified in the appropriate sections of this user manual.

Note: The cross-sectional area of the signal wires may be 0.1 to 1.5mm^2 and should take into account the working voltage of the remote monitoring interface device and the length of the cable route. Inside the UPS the signal cables should be bundled together and tied to the metal frame.

6. Return the UPS to Normal Operation, following the procedure given in the Chapter 9.

12.2.3 Board Installation – 4590056Q

1. Using the connector X1, mount the Extension Alarm Interface Board (4590056Q) in piggy-back fashion on to connector X2 of the AS400 Alarm Interface Board (4590055P.)
2. Connect the external signal cables, as required, to the terminal block connectors identified in the appropriate sections of this user manual.

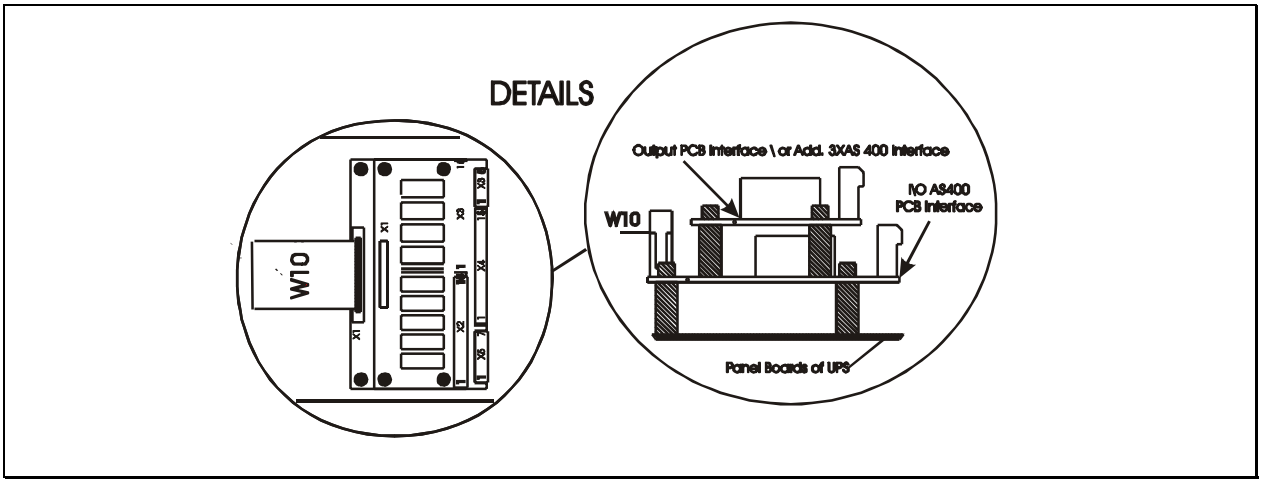


Figure 12-1 – UPS Interface Alarm Boards details

12.3 UPS I\O AS400 Alarm Interface Board (P\N 4590055P)

This board has several functions as described below.

12.3.1 Remote Control Inputs (X5)

The Interface Board has facilities to accept three remote control inputs on terminal block (X5), as shown in figure 12-2. The remote controls are:

Reference			Definition	Description
X5	1-2	❸	*Battery ground fault* (Insert jumper on X6 2-3)	This input is used to enable the alarm on the UPS operator's panel both in the event of insulation loss of the battery (if the battery ground fault detection option has been installed).
	3-4	❷	*Inverter Off*	This remote input allows the inverter to be shut down (transferring the load to the bypass supply). See Note 3
			Rectifier Off	This remote input allows the rectifier to be shut down. See Note 3
			Static switch Off	This remote input allows the static switch to be shut down. See Note 3
	5-6	❶	*On generator*	This remote input is most often used in conjunction with a stand-by generator, which may be activated when the input mains supply fails. The effects of this input can be configured from the Operator Control Panel to a combination of the following: reduce the input current limit; reduce the battery current limit; inhibit the inverter/bypass synchronisation .

The voltage applied to these terminals must be generated by an external power source and not taken from the UPS internal low voltage supplies.

NOTE

1) Control is achieved by application of control signals (12V d.c. or a.c.) to terminal block X5 as shown in figure 12-2.

2) Jumper X6 on 1-2 blocks the load on the inverter side, thus preventing the switching to the bypass mode (this function is used for the LBS option).

3) Depending on customers' requirements, all three inputs or each of them can be used to enable the specific functions described above. This can be done by selecting IN/OUT BOARD on the operator's panel. This window is protected by a password that restricts the access of users to complex control functions, which are however accessible without limitations to authorized servicing personnel. Always verify that all changes of original settings are recorded in the commissioning documentation.

12.3.2 AS 400 Interface (X3)

The AS400 Alarm Interface Board connects the four most operationally critical UPS alarms to an IBM AS400 computer, which is designed to monitor such alarms and respond to their appearance. Connection to the AS400 is provided on the Alarm Interface Board via a terminal block X3. These alarm signals are provided by volt-free relay contacts, Maximum contact rating is 50 Vdc @ 1A.
The alarms in question are:

- **UPS Bypass** ❾ (RL-K6)

This warning message signals that the load is powered by the static bypass and is not protected by the distortion of the mains supply. This signal is disabled if the 'ECOMODE' mode has been selected.

- **Battery Low** ❿ (RL-K7)

This alarm is enabled only if the maintenance bypass switch is open, the load is *"on-inverter"*, and the rectifier is stopped for any reason. The alarm then activates when the battery voltage falls below the minimum programmed Low Battery Level.

- **UPS ON** 11 (RL-K8)

This warning message signals that the load is suppied by the UPS regardless of whether it is used as inverter or static bypass. This signal is disabled if the load is set to the maintenance bypass.

- **Utility Failure** *(Rectifier mains)* 12 (RL-K9)

This alarm is enabled only if the maintenance bypass switch is open and the load is *"on-inverter"*. The alarm then activates when the rectifier is stopped for any reason.

❖ **Common** 13

12.3.3 Alarm Outputs (X4)

In addition to the AS400 alarm outputs the Interface Board also contains a number of relays whose contacts provide a set of volt-free alarm outputs that are connected to terminal block X4 as shown in figure 12-2. These outputs can be used to drive an external alarms monitoring device. Maximum contact rating on terminals = 50 Vdc @ 1A.

The alarms in question are:

- **Bypass failure** ❹ (RL-K1)
  This alarm is active when the bypass voltage is low (undervoltage alarm), the bypass voltage is high (overvoltage alarm) or absent; or the bypass-side static switch is selected blocked via the Operator Control Panel menuing system.
- **Low battery** (pre-alarm) or Battery CB open ❺ (RL-K2)
  This alarm is active when the battery breaker is open, the battery fuse is open or the Low Battery alarm is active.
- **Load on static bypass** ❻ (RL-K3)
  This warning message signals that the load is supplied by the static bypass and not protected by the distortions of the mains supply. This signal is opposed to 'LOAD ON INVERTER' on relay K5. The signal is normally present when the UPS is in 'ECOMODE' and running in normal operating conditions.
- **Load on maintenance bypass** ❼ (RL-K4)
  This status message signals that the load is supplied by the maintenance bypass line and that it is not protected by the distortion of the mains supply. The alarm is enabled by the closing of the maintenance manual bypass switch (Q3).
- **Load on inverter** ❽ (RL-K5)
  This status message signals that the load is normally supplied by the inverter.

Note: When using the above contacts for remote alarm annunciation, the power supply for the remote indicators must be provided from an external power source. Under no circumstances should the UPS internal low voltage supplies be used for this purpose.

12.3.4 X2 Extension

The X2 connection on the board is provided to interface to the Extension Alarms Interface Board (P\N 4590056Q), which is described next.

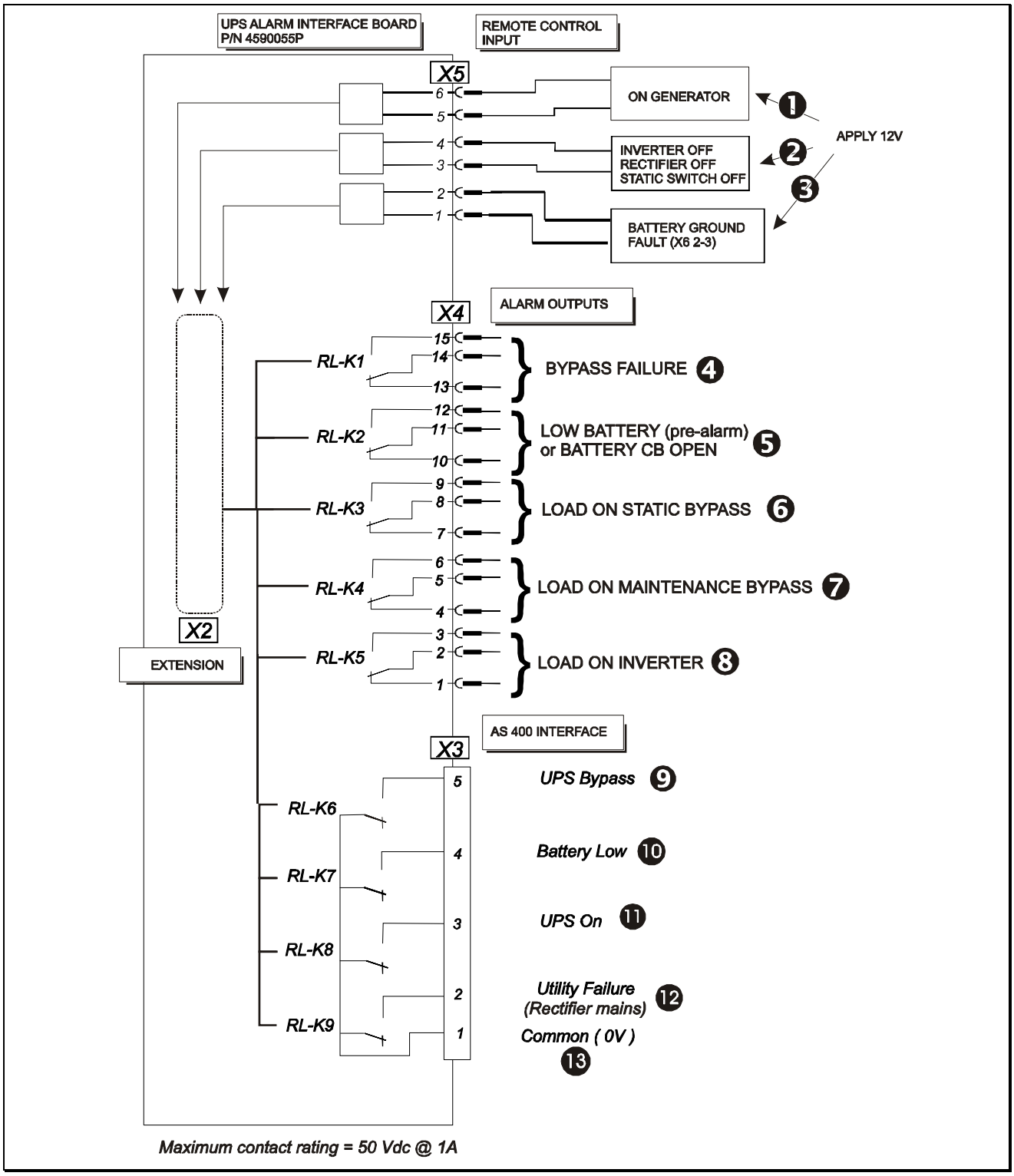


Figure 12-2 – UPS I\O AS400 Alarm Interface Board (P\N 4590055P)

12.4 UPS Extension Alarm Interface Board (P\N 4590056Q)

This board is connected (piggy back style) directly via connector X1 onto the Interface Board connector X2 of 4590055P as shown in figure 12-1. This board can only be used in conjunction with the Interface Board (4590055 P).

12.4.1 Standard Alarm Outputs

The Extension Alarm Interface board contains a number of relays driven by alarm signals generated within the UPS, whose contacts provide a set of volt-free alarm outputs that are connected to terminal blocks X2 and X3 as shown in figure 12-3. These outputs can be used to drive an external alarms monitoring device.

Reference			Definition	Description
X2	RL K1	15 NO 14 COM 13 NC	**BATTERY ON LOAD ❶**	This message informs the operator that the load is supplied from the battery system and the battery is discharging. This alarm is enabled when the battery breaker is closed and the battery fuse in intact and then active when rectifier block signal is present.
	RL K2	12 NO 11 COM 10 NC	**OVERLOAD ❷**	This message informs the operator that the load exceed 150% of the UPS rating, and the load will transfer to bypass some time later depending on the degree of overload present.
	RL K3	9 NO 8 COM 7 NC	**INVERTER OVERTEMPERATURE ❸**	This alarm is active when an output transformer overtemperature or an inverter overtemperature is enabled (thermostat on heatsink is intervened).
	RL K4	6 NO 5 COM 4 NC	**INVERTER UNSYNCHRONISED ❹**	This warns that the inverter is not synchronised with the bypass supply, which is normally due to a problem with the bypass supply being outside an acceptable frequency window. In 1+N parallel system one (or more) UPS is not synchronised with other modules or with bypass supply.
	RL K5	3 NO 2 COM 1 NC	**COMMON ALARM ❺**	This is a general alarm facility and is activated from any of the following: • Rectifier blocked. • Battery c.b. open, battery fuse fail, DC bus undervoltage. • Inverter is unsynchronized. • INV: Overtemperature is active. • OUT: undervoltage/ no voltage, wave form error. • Inverter: OFF, blocked, INV: current limit, undervoltage. Additional alarms for 1+N configuration: • Bypass-side static switch is blocked (inhibited) by hardware. • Bypass supply failure. • Bypass OFF/ overvoltage/ undervoltage • Maintenance Bypass isolator is closed • Number inverters not OK
X3	RL K6	15 NO 14 COM 13 NC	**FAN FAILURE ALARM ❻**	This message informs the operator that there is a failure in the outgoing air ventilation system (with option included).
	RL K7	12 NO 11 COM 10 NC	**TRANSFER ON BYPASS INHIBIT ❼**	This alarm is activated from any of the following: • the bypass has been inhibit by the operator from either the front panel display or an external PC. • one or more of the UPS static switch SCR's has developed a fault. • input ac supply failed or out of specified acceptable range. • bypass switch open. This alarm is valid only for UPS units in single configuration and not for the '1+N' configuration.
	RL K8	9 NO 8 COM 7 NC	**RECTIFIER/MAINS FAILURE ❽**	This message informs the operator that the rectifier is not producing its correct output voltage; this can be caused by: an operator selection to OFF, input rectifier ac supply failed or out of specified acceptable range, rectifier switch open or an internal fault.
	RL K9	6 NO 5 COM 4 NC	**BACK FEED FAULT ❾**	This message informs the operator that failure of the Bypass static devices has resulted in voltage being fed back to the bypass supply input.
	RL K 10	3 NO 2 COM 1 NC	**BATTERY C.B. OPEN**	The battery circuit breaker is open. Note that if the mains power fails then the UPS output will also fail together with load power, since the inverter has no battery back-up. Verify that the jumper is setting on X4 1-2.
X1		Connect piggy-back to X2 of Alarm Interface Board (P\N 4590055P)		

Note: relay contacts refer to the power-free card.

Maximum contact rating on aux terminals: 50 Vdc @ 1 Amp.

Note: When using the above contacts for remote alarm annunciation, the power supply for the remote indicators must be provided from an external power source. Under no circumstances should the UPS internal low voltage supplies be used for this purpose.

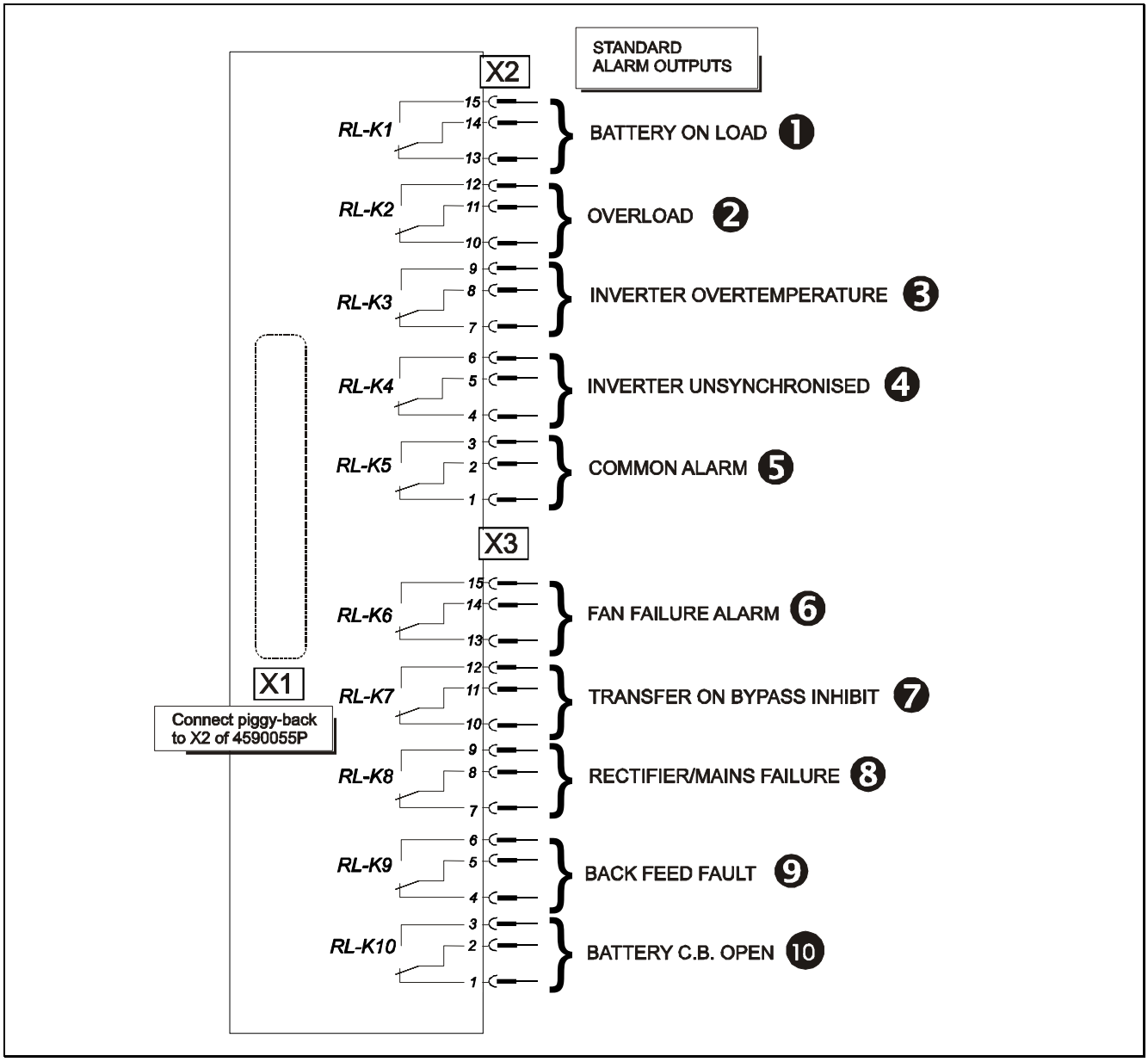


Figure 12-3 – UPS Extension Alarm Interface Board (P\N 4590056Q)

12.4.2 Field defined alarms (X3 auxiliary terminal board)

The user may ask for the standard alarms to be replaced with five user-defined alarms, which can be selected among the 80 alarms available within the UPS. It will however be necessary to set the related alarm code (see paragraph 10.2) by means of the relevant selection window in the operator's panel. The UPS will make this available on the X3 terminal block of *alarm interface extension board (*Code 4500056Q) as soon as it is detected. This window is protected by a password that restricts the access of users to complex control functions, which are however accessible without limitations to the authorized servicing personnel. From DEFAULT WINDOW, pressing ENTER key, select FUNCTION>PASSWORD> IN/OUT BOARD>OUT RELAY Kxx. Always verify that all changes of original settings are recorded in the commissioning documentation.

12.5 Input Harmonic Filter (11th)

Properly designed tuned filters are available to reduce the most critical harmonic pollution.
They also can improve the Liebert Hipulse E input power factor, leading Power Factor (P.F.) from 0,8 up to 0,93.
These optional input filters can be installed without any additional system footprint and their performances are shown in Chapter 5 'System performance'.

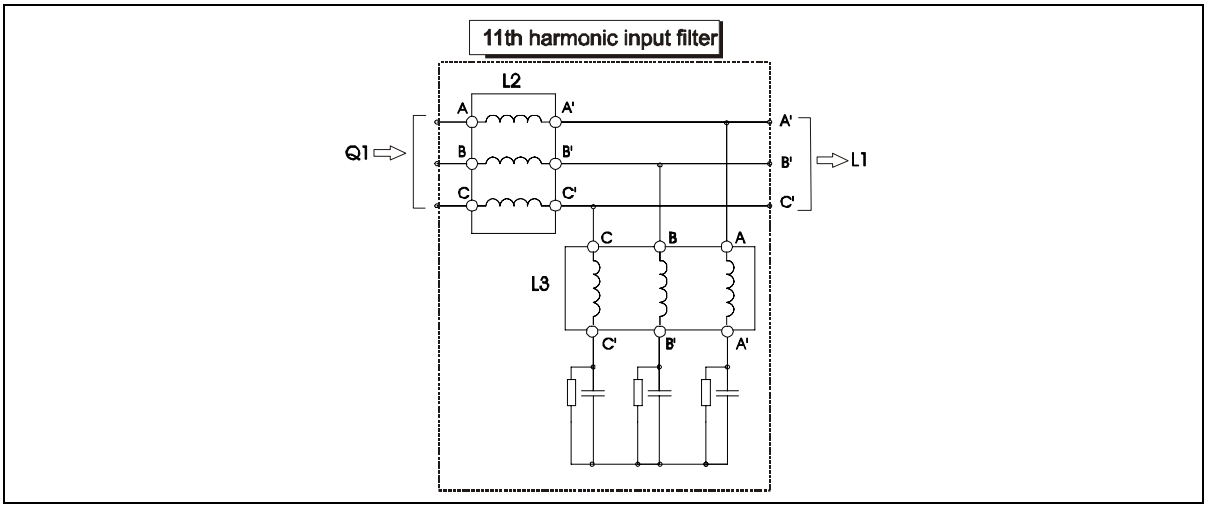


Figure 12-4 – Optional input filter schematic

11th harmonic filter

This filter can be fitted in a 12 pulse UPS.

Model	P/N	Weight (kg.)
500 kVA UPS	4641067P	135

12.6 Additional autotransformer

When the mains voltage or the voltage required by the load has a different value in respect to the UPS standard value, an autotransformer for the voltage adjustment can be added.

12.7 Input isolation transformer (IT)

Input Isolation Transformers are required in case of having a galvanic isolation between Input/Bypass Mains and UPS Output. They are normally a Delta/ZigZag (△/Z) double wound transformer and they are available for every range of UPS (80-800 kVA). They are housed in an optional cabinet in which the non automatic circuit breaker with fuses are also installed. Input isolation transformers are designed to power both rectifier and bypass mains, depending on their size.

The transformers have 0° phase shift to also allow connection in the bypass line.
The IT cabinet can be positioned alongside the main UPS equipment.
All cabinets are secured and bonded together using the holes provided in the cabinet side struts. Each cabinet is supplied without side covers, as the cover from the basic UPS is then used. If the cabinet is to be located away from the UPS, connection cables and side panels will be necessary.
All IT models are cooled with the aid of internal removable fans.

The components of the Input isolation transformer are matched to the UPS capacity, resulting in different part numbers for each system as follows:

Model	P/N	Dimensions (WxDxH) mm.	Weight (kg.)	Switches	Fuses (A)
500 kVA UPS	5312133V-E	1210 x 978 x 1900	1530	3p – 1250A	1250 Gr.4

Note: Side panels not included.

When the IT is fitted next the UPS is provided with the power connection cables. If for any raison the IT cannot be fitted next the UPS, please order the optional side panels.

12.8 Degree of protection for the UPS enclosure

The degree of protection for the UPS enclosure satisfies IP 20 standard even in door-opened condition. An option for **IP21/30/31** is also available.

12.9 RS232 communications

This section gives a brief outline of external communication options available for the Liebert Hipulse E UPS.

12.9.1 RS232 communication kit

It is possible to implement local or remote RS-232 communications between the Liebert Hipulse E UPS system and a Personal Computer (PC) using a purpose-designed communications kit.
An RS232 (X8) connector is fitted on the Operator Logic Board as standard on all UPS systems to allow remote interfacing of the UPS front panel control and indication functions.
The optional RS232 communication kit allows to transfer some information available from the UPS display system and converts it into a customer-usable form for local or remote display.

When installed, the communications kit enables the following functions to be carried out from the PC terminal:

- Set and modify the UPS system parameters.
- Monitor the UPS alarms status, and provide an alarms history if required.
- Monitor system analogue parameters (voltage, current, frequency, power, temperature).
- Activate UPS commands (set date/time, ON-OFF of rectifier / inverter / bypass, etc.).
- Detect UPS communications set-up (node configuration).

Local operation is achieved by connecting a personal computer (PC) directly to the UPS module via an RS-232 cable of up to 15m length. For communication over greater distances a pair of modems are required to provide the necessary interface with the Public Telephone Service Network (PTSN).

The UPS control system is ready-prepared for external communications via connectors X9 and X8 on its Operator Logic Board (located back on the front door): connector X9 and X8 provide an RS-232 Interface.
The hardware includes a male connector fixed on the aluminium panel fitted to the lower left-hand region of the module (under the auxiliary terminal block) which is connected to the Operator Logic Board (via X8). The output connector (X9 on the aluminium panel) is then connected to the PC for a local installation or to a modem in a remote installation. The X9 connector is a 25 pin D-type male connector (D-25) with a standard RS-232 pin out.

12.9.2 Modem

Using a modem, Liebert Hipulse E is able to transmit the status of the UPS to a remote location over a telephone line. For this purpose, space has been left on the inner side of the UPS door. The modem should be connected to the RS232 (X8) on the Operator Logic Board. The modem power supply may be derived from the 250Vac max supply inside the UPS (the power cable should be supplied with modem). The telephone line should be secured in the cable passage shown in the figure in Chapter 6.

12.9.3 Communication kit – installation with several modules

It is possible to use the communications kit to monitor and control up to eight UPS modules. Such modules may be configured as independent Single module systems, 1+N systems, or Multimodule.

From a hardware viewpoint, when two (or more) modules are connected to the communications system only one module is connected to the PC/Modem via the Communications Interface Board - this is classed as the master module. The remaining modules, which are classified as slave modules, are daisy-chained to the master module via an 3 poles connector X4 input and X5 output of the Operator Logic Board, as shown figure below, thus the control and operational data for each module is transmitted through the communication link to the P.C. via the master module. Note that the connectors (X4&5) are the female 3-pin.

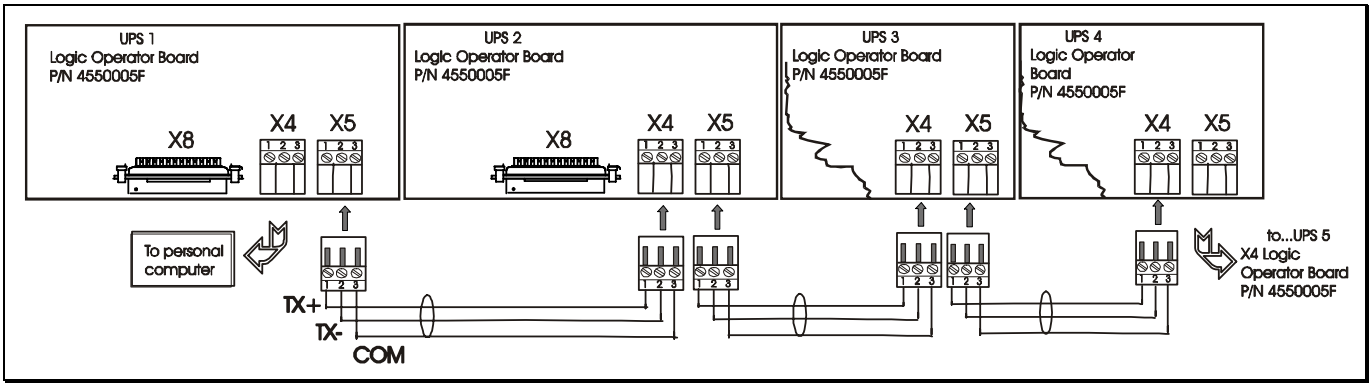


Figure 12-5 – RS485 connections

12.9.4 NIC (Network Interface Card)

The Liebert Network Interface Card (NIC) provides Ethernet connectivity for your Liebert UPS equipment.
The card allows monitoring the operating status, and communication of alarms via the network.
The NIC transforms Liebert units into intelligent managed nodes in your network, enabling in-band communications with network management systems (NMS) that monitor the well-being of your computing/communication infrastructure.
This protocol allows simple integration into the network management system, thus leveraging prior investment and established procedures.
The NIC may be ordered as a factory-installed option, or in a kit for field-retrofit to existing Liebert UPS units.

12.9.4.1 Connection with UPS

- Connection with UPS systems is through Ethernet 10BaseT connection
- A compatible Network Card Adapter (10BaseT or similar) will have to be fitted on the PC
- Connection can be provided through a standard Network Hub or Switch, or through a direct cable connection

A serial connector is available on the OpenComms NIC to allow configuration of card parameters (IP Address, SNMP community name and SNMP station configuration) as well as for firmware updates.
The Ethernet line should be secured in the cable passage shown in the figure in Chapter 6.

12.9.4.2 Information provided with the SNMP protocol

The NIC SNMP interface provides information on the following 6 groups: Identification, Battery, Input, Output, Bypass and Configuration.

12.9.5 Modbus/Jbus

Modbus is a field standard introduced in 1979 by Modicon. Modbus works on a "master/slave" protocol using a non-powered two-wire (RS485) network. The controlling software, normally the BMS itself, will be the 'Modbus master', allowing control of up to 247 slave addresses: in practice, typical implementations will support up to 32 nodes per RS485 port.
Building Management Systems (BMS) are sophisticated programs that help facility managers and technicians monitor and control temperature and ventilation conditions, security and fire safety, power distribution systems as well as power supply systems - like UPS units - in non-residential buildings.The Modbus/Jbus option is installed within Liebert Hipulse E UPS by replacing a programmable component - namely an EPROM - on the UPS Logic Board. The Logic Board is normally fitted with a component that allows communication via the standard IGMnet protocol - the protocol used to get information from the UPS via the serial connector - when this is removed, in order to fit the Modbus/Jbus option, it will not be possible to use the SNMP card (OpenComms NIC).

Jbus

Jbus is a subset of Modbus, generally identified as the "French" version of Modbus, because it was originally developed in France. Conversion between the two protocols (Modbus and Jbus) is straightforward and it should always be possible to use them interchangeably.
The UPS is not programmed to use the MODBUS protocol and must be configured from the UPS operator panel menu.

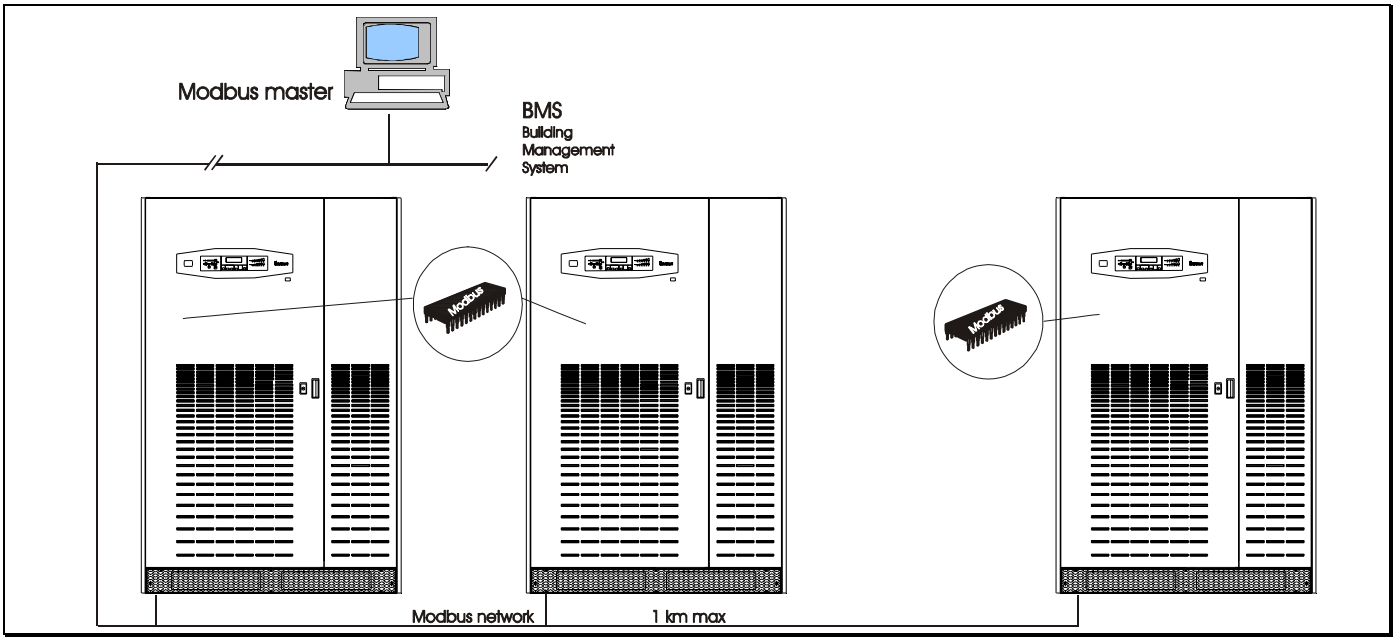


Figure 12-6 – Modmobus network

12.9.6 Remote control panel

The Remote Alarm Monitor (RAM) (P/N 4305003B) may be used to view the principal signals, alarms, and warnings relating to UPS status from a distance (up to 1 km). It can be connected up to six UPS via RS-485 serial interface. An audible warning accompanies the above alarm conditions and it can be cancelled by pressing the "reset" push-button, while the alarm indication will remain illuminated until the condition is rectified. This type of Operator Interface can be divided in three functional areas:

- LCD Display, equipped with a 4x20 character alphanumeric display, which automatically provides information relating to your system and metered values current status. The display is menu driven, permitting you to easily navigate through operator screens.
- • System alarm LED, (left side) representing the main information about your system status.
- • System apparatus LED, (right side) representing the main information about your connected apparatus status.

12.9.6.1 Technical features of the remote alarm monitor

The principal technical features are:

Dimensions (LxDxH)	230x192x70 mm
Weight	about 1 Kg
Colour	RAL 7035
Remote Alarm Monitor power supply	from X22 socket through power supply unit output
Power supply unit (supplied)	Input: 220\240 Vca — 50\60 Hz
	Output: 24 Vcc
Absorbed power	about 6 VA
Installation	Horizontal (desktop)
	Vertical (wall-mounted)
Serial interface	RS232 DTE (X8)
" "	RS485 (X21)

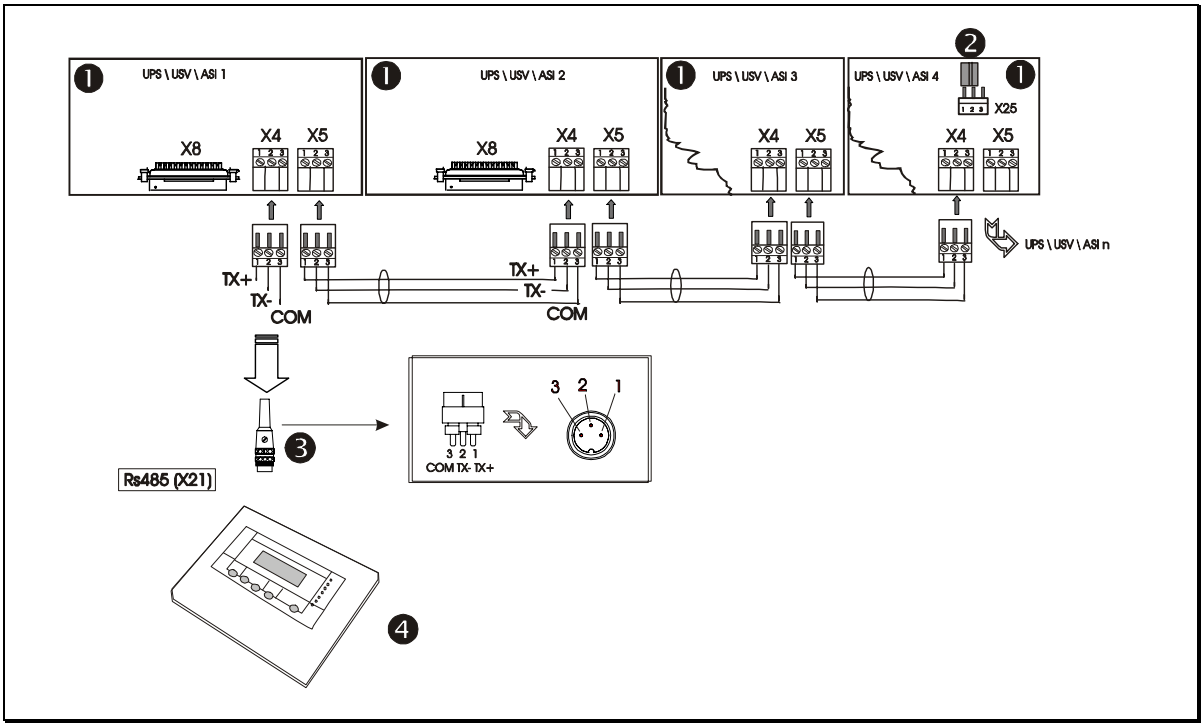


Figure 12-7 – RS485 connections for remote control panel

	Legend
❶	Operator Logic board (P/N 4550005F)
❷	Jumper
❸	Loose plug for RS485 connection
❹	Remote control panel

NOTES: